

David Yallup

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Research Themes: MCMC · Nested Sampling · GPU-Accelerated Inference · Generative AI for Science

Profile

Postdoctoral researcher in probabilistic machine learning and scientific inference, specialising in GPU-accelerated Bayesian computation and generative surrogate modelling for physical simulations. Lead developer and contributor to open-source JAX scientific software, with experience translating research methods into robust, reusable code and collaborating across academia and industry.

Skills

Statistical/Generative AI: Bayesian inference; simulation-based inference; uncertainty quantification; surrogate modelling; diffusion/flow-matching models

Software: Python; JAX; PyTorch; HPC; GPU; C++; version control (Git); CI/testing; packaging; documentation

Research: Method development; benchmarking; reproducible workflows; scientific computing for cosmology/GW/HEP

Collaboration: Cross-disciplinary research; industry-facing delivery; mentoring and supervision; data science seminar organiser

Experience

Kavli Institute for Cosmology, University of Cambridge

Postdoctoral Research Associate

2021–

Member of the Handley-lab research group:

- Developing GPU-accelerated inference for next-generation cosmology, gravitational wave, and particle physics experiments
- Building simulation-based inference and advanced MCMC tools in JAX/BlackJAX
- Bayesian statistics for scientific inference problems

Corpus Christi College, University of Cambridge

Research Associate

2022–

Polychord Ltd.

Research Scientist

2021–

Cambridge spin-out applying Bayesian methods to industrial problems including:

- Molecular structure prediction, battery design optimisation, sensor placement

Education

UCL

PhD Particle Physics

2015–2019

Thesis: “*Constraining new physics with fiducial LHC measurements,*” supervised by Prof J. Butterworth.
Recipient of UCL HEP postgraduate prize.

Durham University

MSc Particles, Strings and Cosmology

2014–2015

Durham University

MSci Natural Sciences, Maths and Physics

2009–2013

Grants

| | |
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| UKRI AIRR Gateway Award: Real-time gravitational wave inference | |
| <i>£50k Isambard-AI GPUh credits</i> | 2026 |
| Google Cloud for Researchers | |
| <i>\$5k Google Compute Engine GPU credits</i> | 2025 |
| Kavli Foundation | |
| <i>£3k to host Cosmological Inference in High Dimensions workshop</i> | 2024 |
| Corpus Christi College, University of Cambridge | |
| <i>College Research Associateship</i> | 2023 |
| Marie Curie Early Career Researcher | |
| <i>£30k for academic secondment and travel grant</i> | 2016–2019 |

Supervision

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|---|--|
| Part II Statistical Physics | Institute of Astronomy (Maths) |
| <i>University of Cambridge</i> | 2025 |
| 4 groups of 2 students, ~40 hours | |
| Part II Relativity | Natural Sciences Tripos (Physics) |
| <i>University of Cambridge</i> | 2022 |
| 4 groups of 3 students, ~40 hours | |
| Part III Projects | Natural Sciences Tripos (Physics) |
| <i>University of Cambridge</i> | 2021– |
| Primary supervisor for 5 MSc projects, ~20 hours contact each | |
| MSci Project Supervision | Physics and Astronomy |
| <i>UCL</i> | 2016–2019 |
| Co-supervisor for 1 MSc project and 8 MSci students with Prof Butterworth | |

Selected Talks (2024–)

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| NeurIPS – FPI Workshop | |
| <i>San Diego</i> | 2025 |
| Particle Monte Carlo methods for lattice field theory | |
| CamGW: Cambridge Gravitational Wave Network | |
| <i>KICC, University of Cambridge</i> | 2025 |
| Towards real-time gravitational wave inference | |
| Future of SED Fitting | |
| <i>KICC, University of Cambridge</i> | 2025 |
| GPU-accelerated sampling methods | |
| ICLR – FPI Workshop | |
| <i>Singapore</i> | 2025 |
| Nested slice sampling | |
| Gravitational Wave Analysis in the Era of Machine Learning | |
| <i>Royal Astronomical Society</i> | 2025 |
| GPU-accelerated sampling methods | |
| BayesAI Workshop | |
| <i>Lancaster University</i> | 2024 |
| Neural network advances in nested sampling | |
| EU AI for Fundamental Physics Conference | |
| <i>Amsterdam</i> | 2024 |
| Diffusion meets nested sampling | |
| Cavendish Astrophysics Seminar | |
| <i>University of Cambridge</i> | 2024 |
| Diffusion models for accelerated inference | |
| Astrophysics ML Seminar | |
| <i>University of Cambridge</i> | 2024 |
| Simulation-based inference | |

Notable publications *

- [1] **Yallup, David**, *Particle Monte Carlo methods for Lattice Field Theory*, in *39th Annual Conference on Neural Information Processing Systems: Includes Machine Learning and the Physical Sciences (ML4PS)*, 11, 2025 [[2511.15196](#)].
- [2] D.D.Y. Ong, **Yallup, David** and W. Handley, *A Bayesian Perspective on Evidence for Evolving Dark Energy*, [2511.10631](#).
- [3] **Yallup, David**, M. Prathaban, J. Alvey and W. Handley, *Parallel Nested Slice Sampling for Gravitational Wave Parameter Estimation*, in *2nd European AI for Fundamental Physics Conference*, 9, 2025 [[2509.24949](#)].
- [4] A.N. Ormondroyd, W.J. Handley, M.P. Hobson, A.N. Lasenby and **Yallup, David**, *Dynamic or Systematic? Bayesian model selection between dark energy and supernova biases*, [2509.13220](#).
- [5] T. Lovick, **Yallup, David**, D. Piras, A. Spurio Mancini and W. Handley, *High-Dimensional Bayesian Model Comparison in Cosmology with GPU-accelerated Nested Sampling and Neural Emulators*, [2509.13307](#).
- [6] M. Prathaban, **Yallup, David**, J. Alvey, M. Yang, W. Templeton and W. Handley, *Gravitational-wave inference at GPU speed: A bilby-like nested sampling kernel within blackjax-ns*, [2509.04336](#).
- [7] **Yallup, David**, N. Kroupa and W. Handley, *Nested slice sampling*, in *The Thirteenth International Conference on Learning Representations: Frontiers in Probabilistic Inference Workshop*, 2025, <https://openreview.net/forum?id=ekbkMSuPo4>.
- [8] N. Kroupa, **Yallup, David**, W. Handley and M. Hobson, *Kernel-, mean-, and noise-marginalized Gaussian processes for exoplanet transits and H0 inference*, *Mon. Not. Roy. Astron. Soc.* **528** (2024) 1232 [[2311.04153](#)].
- [9] **Yallup, David** and W. Handley, *Hunting for bumps in the margins*, *JINST* **18** (2023) P05014 [[2211.10391](#)].
- [10] **Yallup, David**, W. Handley, M. Hobson, A. Lasenby and P. Lemos, *Split personalities in Bayesian Neural Networks: the case for full marginalisation*, [2205.11151](#).
- [11] **Yallup, David**, Janßen, Timo, Schumann, Steffen and Handley, Will, *Exploring phase space with nested sampling*, *Eur. Phys. J. C* **82** (2022) 678.
- [12] P. Lemos, M. Cranmer, M. Abidi, C. Hahn, M. Eickenberg, E. Massara et al., *Robust Simulation-Based Inference in Cosmology with Bayesian Neural Networks*, in *39th International Conference on Machine Learning Conference*, 7, 2022 [[2207.08435](#)].
- [13] A. Buckley et al., *Testing new physics models with global comparisons to collider measurements: the Contur toolkit*, *SciPost Phys. Core* **4** (2021) 013 [[2102.04377](#)].
- [14] S. Amrith, J. Butterworth, F. Deppisch, W. Liu and **Yallup, David**, *LHC Constraints on a B – L Gauge Model using Contur*, *JHEP* **05** (2019) 154 [[1811.11452](#)].
- [15] G. Brooijmans et al., *Les Houches 2017: Physics at TeV Colliders New Physics Working Group Report*, in *10th Les Houches Workshop on Physics at TeV Colliders*, 3, 2018 [[1803.10379](#)].
- [16] J.M. Butterworth, D. Grellscheid, M. Krämer, B. Sarrazin and **Yallup, David**, *Constraining new physics with collider measurements of Standard Model signatures*, *JHEP* **03** (2017) 078 [[1606.05296](#)].

* As an ATLAS collaboration author I was an author on over 280 collaboration papers; only external small-author-list papers are listed here.