David Yallup

Kavli Institute for Cosmology, University of Cambridge

david.yallup@gmail.com • yallup.github.io • dyallup
yallup • ORCiD: 0000-0003-4716-5817 Google Scholar: david.yallup

I am a postdoctoral researcher based in the cosmology group at the University of Cambridge. My work focuses on Bayesian Machine Learning and *explainable AI*, with applications ranging from industrial challenges to fundamental science at both the biggest and smallest known scales in Physics.

Appointments

2021- **Postdoctoral Research Associate**, *Kavli Institute for Cosmology*, University of Cambridge, Cambridge.

- Primary project – developing novel Bayesian Neural Network methodologies, targeting explainable AI.
- Leading multiple interdisciplinary projects in fundamental science; mixing expertise in Machine Learning, Particle physics and Cosmology.
- Initially funded through an STFC Industry Partnership Scheme, working with a Cambridge Astrophysics spin-out company on developing next generation AI tools for industrial challenges.

Previously

2019-2020 **Postdoctoral Research Associate**, *High Energy Physics group*, UCL, London.
Developing Machine Learning tools for inference over theoretical models at the highest energy frontiers. Assisting supervision of six masters students using software tools I wrote.

2015-2019 **Doctoral candidate**, *High Energy Physics group*, UCL, London.
PhD student working on the ATLAS experiment and with the MCnet collaboration for collider physics theory. Leading development of tools for simulating collider physics, and analysing big data from the experiments for dark matter signals.

Associations

2022- **Corpus Christi College**, *University of Cambridge*, Research Associate.
Associate member of college research community

2021- **Polychord Ltd.**, Research associate.
Partnered with a Cambridge spin out startup data science consultancy, aiding development of novel Bayesian techniques for a wide array of industrial challenges.

Previously

2015-2019 **MCnet Collaboration**.
International multi-institue theory collaboration, core member of UCL node.

2015-2019 **ATLAS Experiment**, *CERN*.
Qualified author on the ATLAS experiment

2017 **Visiting researcher**, *ATLAS Experiment*.
STFC funding secondment at CERN for 9 months on the ATLAS experiment.

2016 **Visiting Researcher**, *Karlsruhe Institue of Technology*, Institute of Theretical Physics.
Marie Curie early career visiting researcher four month project

2013-2014 **Simcorp Ltd.**, *Business Consultant*, Simcorp Ltd., London.

Education

2015–2019 **PhD. Particle Physics**, *UCL*.
Recipient of UCL HEP postgraduate prize for outstanding postgraduate research.
Thesis titled, *"Constraining new physics with fiducial LHC measurements."* supervised by Prof J. Butterworth

2014–2015 **MSc Particles, Strings and Cosmology**, *Durham University*.

2009–2013 **MSci Natural Sciences, Maths and Physics**, *Durham University*.

Grants

2017 **Marie Curie short term Early Stage Researcher grant**, $\sim$ £30k.
Fully funded Marie Curie visiting position at KIT for 5 months.

2015-2019 **MCnet mobility allowance**, *Totalling* $\sim$ £5k.
Awarded numerous travel grants for international conferences under MCnet Marie Curie network.

Students

2022- **Namu Kroupa**, *University of Cambridge*, Part III Natural Sciences project.
Marginalised Gaussian Processes for Cosmology

2022- **Boris Deletic**, *University of Cambridge*, Part III Natural Sciences project, co-supervised w. Dr. Will Barker.
Modified gravity on the lattice

2018 **Harry Saunders**, *UCL*, MSc in Scientific Computing, Lead superviser Profesor Jon Butterworth.
Adaptive sampling for physics models in high dimension

Teaching

Undergraduate teaching

2022 **Part II Relativity**, *University of Cambridge*, Natural sciences tripos (physics).
4 groups of 3 students, $\sim$ 40 hours

2015-2019 **Masters project supervision**, *UCL*, MSci Physics projects.
Lead supervisor Prof. Jon Butterworth, assisted over 10 project students

2016 **First year physics lab demonstrator**, *UCL*.

Technical teaching

2019 Original author of software tutorials for Rivet and Contur particle physics packages. Delivered at two MCnet summer schools.

2019 Young Experiment and Theorist Institute school tutor on Rivet and Contur.

2018-2019 ATLAS UK meeting tutor on the Rivet package and Monte Carlo methods for particle physics.

Dissemination

Invited Talks

2022 **Bayesian Inference in High Energy Physics**, *Durham University*.

2022 **Likelihood Free in Paris**, *L'École Normale Supérieure*, Paris, France.

2021 **Learn the Universe - LFI for Cosmology**, *Flatiron Institute*, NY, USA.

2019 **Les Houches Physics at TeV Colliders**, *Chamonix*, France.

2019 **ATLAS Exotics workshop**, *Naples*, Italy.

2019 **Rencontres de Moriond - EW Interactions and Unified Theories**, *La Thuile*, Italy.

2019 **Young Experimentalist and Theorists Institute**, *Durham*, UK.

2018 **Institute of Physics annual meeting**, *Bristol*, UK.

2018 **MC4BSM**, *Durham*, UK.

2017 **Alpine LHC Summit**, *Innsbruck*, Austria.

Invited Seminars

2022 **Evidence is all your need**, *University of Cambridge*, High Energy Physics seminar.

Outreach

2018 **Science Centre Lectures**, *University College London*, Physics at the energy frontier.
Outreach talk to a group of over 100 sixth form students

2017-2019 **Life at CERN**, *University College London*.
Research introduction talks to third year students in physics at UCL.

Notable publications ⋆

[1] D. Yallup and W. Handley, *Hunting for bumps in the margins*, *In preparation* (2022) .

[2] D. Yallup, W. Handley, M. Hobson, A. Lasenby and P. Lemos, *Split personalities in Bayesian Neural Networks: the case for full marginalisation*, 2205.11151.

[3] Yallup, David, Janßen, Timo, Schumann, Steffen and Handley, Will, *Exploring phase space with nested sampling*, *Eur. Phys. J. C* **82** (2022) 678.

[4] 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].

[5] 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].

[6] S. Amrith, J. Butterworth, F. Deppisch, W. Liu and D. Yallup, *LHC Constraints on a $B - L$ Gauge Model using Contur*, *JHEP* **05** (2019) 154 [1811.11452].

[7] J.M. Butterworth, D. Grellscheid, M. Krämer, B. Sarrazin and D. Yallup, *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 authorlist papers are listed here. Inclusion here represents a first author level contribution.*