Matthew Ward

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PhD candidate in theoretical quantum physics with expertise in numerical modelling, statistical analysis, and machine learning. Proficient in Python and Mathematica, with experience developing and validating AI models in healthcare. Interested in applying quantitative modelling and computational methods to the development of quantum technologies and quantum computing.

Qualifications

University of Southampton 2019 - 2027 (Part-Time)
PhD Physics, "Holographic Descriptions of Gauge Dynamics" (expected)

Lancaster University 2013 - 2017
MSci Theoretical Physics with Mathematics (North America) (**First-Class Honours**)
* Quantum Information Processing: 22.9/24 aggregate score

Eccles Sixth Form Centre 2011 - 2013
A2s (grade): Mathematics (A*), Physics (A*), Further Mathematics (A), AS Psychology (A)

Walkden High School 2007 - 2011
GCSEs (grade): Mathematics (A*), English Language (A*), English Literature (A*), Physics (A), Chemistry (A), Biology (A), Statistics (A), Art (A), Media Studies (A), French (B), Astronomy (B), I.C.T (Distinction)

Employment Background

Sept '19 - Present

Doctoral Candidate in Theoretical Physics - University of Southampton

- Reduce fine-tuning in string-theoretic models of low-energy non-perturbative quantum field dynamics by replacing fixed parameters with empirically motivated dynamic fields.
- Develop optimisation algorithms in Mathematica to calibrate parameters against physical and simulated datasets, formulating systems of differential equations as boundary-value problems and solving them numerically to enforce high-energy asymptotic constraints.
- Use calibrated models to generate quantitative predictions for previously unobserved quantum states (e.g., multi-quark bound states), computing masses and decay lifetimes.
- Implemented sensitivity and uncertainty quantification workflows to map error propagation, compute confidence intervals for model predictions, and stress-test model behaviour under small parameter variations.
- Presented research at the University of Cambridge, the University of Cape Town, and the Yukawa Institute for Theoretical Physics (Japan); co-authored a peer-reviewed publication.

Sept '19 - Present

Medical Physicist - University Hospital Southampton NHS Foundation Trust

- Lead the development and implementation of artificial intelligence (AI) tools for medical image segmentation within the Clinical Scientific Computing (CSC) group, routinely using Python packages including NumPy, SciPy and Pandas.
- Supervise the National Fellowship for Clinical AI (FCAI) research programme within CSC, currently supporting a Cardiology Registrar in evaluating the use of local AI models to independently assess the quality of segmentations returned by commercial AI applications.
- Compare predicted and ground-truth data for model verification using techniques such as linear regression and Wilcoxon signed-rank tests, as well as Monte Carlo analysis to ascertain the statistical significance of data clustering in multidimensional scatter plots.
- Construct efficient data pipelines that automatically curate training data from cloud-based SQL databases and forward predictions to clinical endpoints, publishing code to GitHub.
- Design and develop the CSC group website using HTML and CSS.
- Implement a quality management system (QMS) for in-house software development in line with the ISO 9001:2015 industry standard.

Oct '17 – Aug '19

Junior Research Physicist - Queen Elizabeth Hospital, Birmingham

- Analysed large treatment datasets using Python and Excel to support commissioning of new clinical systems, implementation of treatment techniques, and service optimisation.
- Simulated the impact of free breathing on the cumulative dose distribution of lung radiotherapy treatments using Python, contributing to a publication on the interplay effect.
- Predicted treatment delivery failure rates by correlating incidences with a histogram-based analysis of machine parameter data, findings that were later published in an industry magazine.

July – Sept '17

Medical Physics Intern - Christie NHS Foundation Trust, Manchester

- Developed a Python-based linear regression model using large numbers of prior radiotherapy treatment plans for head and neck cancer patients to predict the minimum radiation exposure to critical organs based on the patient's anatomy.
- Presented how the program became part of the standard treatment protocol at the world-leading cancer centre at an industry conference after it was shown to reduce radiation toxicity whilst improving optimisation times.

Sept – June '17

Study Abroad Ambassador - Lancaster University

- Delivered talks to hundreds of students in first year lectures and at university events to promote the study abroad programme after spending my third academic year at the University of Kentucky, USA.
- Organised on and off-campus events and activities for visiting international students.

May – June '16

Data Acquisition Intern - Fermi National Accelerator Laboratory, Illinois, USA

- Assisted the data acquisition team with HTML/JavaScript web development prior to the first run of the muon g-2 precision experiment at the renowned particle research facility.

Voluntary Experience and Other Achievements

Apr '25 - Present

Ethical Kitchen Garden Volunteer - Bournemouth

Voluntary position helping to set-up and run a local initiative that turns unused green spaces into functioning community gardens, selling the produce to raise funds for charitable causes; the founder and I were recently interviewed about the initiative for BBC radio.

Mar '18 – Aug '19

Voluntary Science Broadcaster - Queen Elizabeth Hospital, Birmingham

Interviewed early career academics from the University of Birmingham on the hospital radio network to inform patients and the public about advances being made in medical research.

2013 – '17

Outreach at Lancaster University

- Volunteered at local primary schools by delivering outreach programmes, running on campus activity days and completing a three-month teaching placement to assist pupils struggling with numeracy.
- Contributed to the Mathematics department's successful Silver Athena Swan award application through work with the Equality Challenge Unit.
- Awarded the Lancaster Gold Employability Award in recognition of extracurricular engagement and career preparation.