

Lawrence Wu

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Education

University of Cambridge *MSc Physics* Oct.2022–Jun.2023

- Thesis: Calabi-Yau Metric Approximations using Graph Neural Networks
- Quantum Field Theory, Advanced Statistical Physics

University of Cambridge *BA(Hons) Physics, 1st class* Oct.2019–Jun.2022

- Scored over 90% in 2/4 final year core modules (General Relativity, Electrodynamics)
- Computing Project: Simulation of the Ising Model of Ferromagnetism
- Literature Review: Development of Quantum Computing Hardware

Relevant Modules: Statistical Physics, Advanced Quantum Mechanics, Particle Physics, Linear Algebra, PDE, Complex Analysis, Group Theory, Rep Theory, Differential Geometry

West London Free School (UK) *Sixth Form* Oct.2017–Jun.2019

- A-Levels (All A*s): Physics, Maths, Further Maths, Chemistry.

Taipei Municipal Jianguo High School (Taiwan) *High School* Sept.2016–Oct.2017

- Ranked 1st in entrance exam for the governmental Gifted Class of Mathematics and Science.

Awards

- United Steel Companies Scholarship, St John's College, University of Cambridge (2020, 2022)
- Top Gold, British Physics Olympiad (2019)
- Distinctions, British Mathematics Olympiad (2018 & 2019)

Publication

Investigation of Cosmic Preferred Directions in the Cosmic Microwave Background Using New Strategies, Lawrence Wu & Jiun-Huei Protty Wu (in preparation).

Research Experience/Projects

Calabi-Yau Metric Approximations using Graph Neural Networks Oct.2022–May.2023

Supervisor: Prof. Pietro Lio, Computer Laboratory, University of Cambridge.

- Deducing numerical Ricci flat metrics for different C-Y manifolds through GNNs by manifold graph discretisation

Preferred Directions in the Cosmic Microwave Background (CMB) Aug.2021–present

Supervisor: Prof. Jiun-Huei Protty Wu, Department of Physics, National Taiwan University.

- Independently developed the codebase, which analyses data with over 50 million pixels each
- Applied new strategies to investigate possible preferred axes or directions in the observed full-sky

CMB maps.

Efficient Wordle Solver based on a Complete Graph

Feb. 2022

Independent research on Interesting Problems

- A rapid brute force solver in python based on the complete directed graph of all 6000 5-letter words
- The directed graph was simplified into a simple graph by applying a non-trivial symmetry between the edges
- Concluded the best strategy of starting with "Aloes" with an expected guess count of 3.2 guesses

Simulation of the Ising Model

Oct.2021–Apr.2022

Undergraduate Computational Project.

- Implemented and Investigated the Ising Model using Monte-Carlo optimisation algorithms.

Quantum Computing Hardware Research Review

Oct.2021–Apr.2022

Supervisor: Prof Mike Payne, Department of Physics, University of Cambridge.

- Looked into emerging technologies of Quantum Computer Hardware and their current difficulties.

Simulation of the domestic and international spreading of COVID-19

Mar.–Jun.2020

Independent research on Models building.

- Simulated the spreading by modelling individuals as repulsive particles.
- Investigated how the spreading rate varies with the strictness of quarantining, travel restriction and social distancing
- Determined how the rate of spreading varies with the vaccination rate.

Connect Four AI

Jun.–Aug.2018

Independent research on Machine Learning.

- An unbeatable AI that plays Connect4 based on Monte Carlo Tree Search (MCTS).
- Investigated the difference between different Selection Algorithms in MCTS.

Work Experience

M2 Digital Asset Management Summer Intern

Jun.–Jul.2021

Project: Research and Development of Bitcoin Pricing Models.

- Estimated the average mining cost per coin from historical mining difficulty and ASIC chip efficiency data.
- Developed codes to estimate the probability distribution of future BTC prices by using current option prices.

Programming/Computers

Python (Numpy, Scipy, Scikit, Tensorflow, PyTorch), C++, L^AT_EX, Linux

Hobbies

Surfing, Skateboarding, Speed Cubing, Electronic Music, DJing