

# Lawrence Wu

St John's College, St John's Street, Cambridge CB2 1TP

☎ (+44)7955105921 • ✉ shw43@cam.ac.uk

## 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.

- A Connect4 agent based on Monte Carlo Tree Search (MCTS).

## **Work Experience**

---

### **University Surf Society Trip Secretary**

*Jun.2022–Present*

- Organised a 50-people surf trip to Morocco with a \$20k budget.
- Currently working on another 50-people trip to the Canary Islands.

### **Physics Olympiad Tutor Tutoring**

*Jun.2022–Present*

- Tutoring for the preparation of IPhO, BPhO and other advanced physics competition.

### **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++,  $\text{\LaTeX}$ , Linux

## Hobbies

---

Poker, Surfing, Skateboarding, Speed Cubing, DJing(House)