# Lawrence Wu

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## Education

**University of Cambridge** *MSc Physics* *Oct.2022–Jun.2023*
- Thesis: Combinatorial Optimisation of the Ising model with 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)

## Research Experience/Projects

**Combinatorial Optimisation of the Ising model using GNNs** *Oct.2022–May.2023*
*Supervisor: Prof. Pietro Lio, Department of Computer Science, University of Cambridge.*
- Developed a Graph Neural Network(GNN) for solving Ising energy optimisation(QUBO) problems through Polarised Attention Graph Diffusion

**Preferred Directions in the Cosmic Microwave Background (CMB)** *Aug.2021–present*
*Supervisor: Prof. Jiun-Huei Proty 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 using the Word Correlation Graph** *Feb. 2022*
*Independent research on an interesting problem*
- A rapid brute force solver in python based on the complete directed correlation graph between all 6000 5-letter words
- The directed graph was simplified into a simpler 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.

**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–Jun.2023*

- Planned and organised two 50-people surf trips to Morocco and the Canary Islands with budgets of over $20k

**Physics Olympiad Tutor** *Tutoring* *Jun.2022–Jun.2023*

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

## Programming/Computers

Python (Numpy, Pandas, PyTorch), C++, LaTeX, Linux

## Hobbies

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