

# Lau Pak To (Ryan)

## CONTACT INFORMATION

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Email: ryanlaupakto2000@gmail.com  
Phone: +44 7311070440 (UK)

GitHub: <https://github.com/SavitarRL>  
Website: <https://savitarrl.github.io/>

## EDUCATION

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### University College London (UCL)

September 2019 - Present

BSc Natural Sciences (Major: Physics, Minor: Physical Chemistry)

- Year 1&2 Overall: 1<sup>st</sup> Class Honours
- Recipient of the Brian Duff Summer studentship to conduct Theoretical Condensed Matter Physics research
- Final Year Project (Literature Review): Classifying Topological Phases of Quantum Matter using Tensor Networks
- Silver-medalist of the University Physics Competition 2020
- Associate Member of the Institute of Physics (IOP)
- Co-founder and Treasurer of Arts for Mental Health (ARTSMH)

### Ardingly College (UK)

September 2017 - June 2019

Sixth Form

- A-Levels: Mathematics (A\*); Physics (A); Chemistry (A)
- Competitions: British Physics Olympiad: Commendation (2019); RSC Chemistry Olympiad: Silver (2019), Bronze (2018); Google Science Fair 2018 (Certificate of Recognition); Internal & external sports and music competitions
- Academic Achievements: Distinctions & Academic Awards in Physics and Mathematics; Maureen McDonnell Prize (Scholarship)

## RELEVANT RESEARCH EXPERIENCE

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### Classifying Topological Phases of Quantum Matter using Tensor Networks

Sept 2021 - Present

*Literature Review on Theoretical Condensed Matter & Computational Physics*

UCL, UK

Supervisor: Professor Andrew Green

Research and review on using tensor network techniques to classify topological phases of matter.

### Topological phase transition in $S=\frac{1}{2}$ spin chains with alternating ferromagnetic (FM) and antiferromagnetic (AFM) couplings and exchange anisotropy

June 2021 - August 2021

*Theoretical Condensed Matter Physics*

UCL, CMMP, UK

Supervisor: Dr. Frank Kruger

Conducted theoretical research on topological phase transitions of the suggested model and constructed its topological phase transition diagram numerically using Python after deriving coupled self-consistent equations.

### The 3-Coloured Distributive Consensus Problem

June 2021 - July 2021

*Wolfram Summer School Fundamental Physics Track*

Online

Supervisor: Hatem Elshatlawy

Cellular automata was reviewed and used to describe phase transitions. A computational essay was written in a Mathematica Notebook as a contribution to the Wolfram Physics Project: <https://community.wolfram.com/groups/-/m/t/2312007>

## WORK EXPERIENCE

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### Research Intern

June 2021 - August 2021

*Brian Duff Summer Studentship (Theoretical Condensed Matter Physics)*

UCL, CMMP, UK

Research Topic: Topological phase transition in  $S=\frac{1}{2}$  spin chains with alternating ferromagnetic (FM) and antiferromagnetic (AFM) couplings and exchange anisotropy

### Undergraduate Research Assistant/Mentee

January 2021 - April 2021

*UCL Connect.ed Mentorship Project*

UCL, UK

Research Topic: Machine Learning in Stock Markets

### Private Tutoring

Summer 2019, 2020

*Self-employed (through recommendations)*

Hong Kong

One on one tutoring on topics of A-Level Physics and Mathematics

## SUMMER SCHOOL

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### Wolfram Summer School

June 2021 - July 2021

*Fundamental Physics Track*

Wolfram Research / Wolfram Physics Project

<https://education.wolfram.com/summer-school/programs/physics/>

Participated in lectures of Physics and Mathematics, joined Mathematica training workshops and conducted a research project. (Title: The 3-Colored Distributive Consensus Problem)

## COMPETITION

### The University Physics Competition

November 2020

*Quadcopter Stability in Wind: Silver Medal*

<http://www.uphysicsc.com/>

<https://www.ucl.ac.uk/mathematical-physical-sciences/news/2021/jan/ucl-natural-sciences-students-win-silver-medal-2020-university-physics-competition>

Supervisor & Team Sponsor: Dr. Frank Kruger

Solved a real-life problem by implementing classical mechanics and computation simulation in a team of 3 representing UCL. A formal paper was written in  $\text{\LaTeX}$  within 48 hours. <https://drive.google.com/drive/folders/1zf8b-X1uo8PzFvZiwtYG0lvUieJ02r5p?usp=sharing>

## ADDITIONAL RESEARCH EXPERIENCE

### Machine Learning in Stock Markets

January 2021 - May 2021

*UCL Connect.ed Mentorship Research Assistant/Mentee*

UCL, UK

Supervisor: Dr. Ava Lee

Learnt and implemented Machine Learning models on large, collected datasets of stock markets to predict its trends.

### Birdsong Audio Signal Analysis

March 2021

*Scientific Programming Module (Python)*

UCL, UK

Supervisor: Dr. Peter Bratby

Our team aimed to identify different bird species by performing Fourier Transforms (FT) on bird song audios. [https://github.com/SavitarRL/NatSci-Computing/tree/master/Group%20Project/NSCI0007\\_Group\\_Project](https://github.com/SavitarRL/NatSci-Computing/tree/master/Group%20Project/NSCI0007_Group_Project)

### Molecular and Business Modelling

June 2020 - September 2020

*NatSci Innovation Lab 2020*

UCL, UK

Our team used LAMMPS to gain knowledge about molecular modelling with an aspect of business modelling with the help of Python. <https://mminnovationlab2020.blogspot.com/search/label/Project%20Updates>.

### Quantum Chemistry with an application on Drug Design

Sept 2019-March 2020

*Interdisciplinary Research Skills Module*

UCL, UK

Our team reviewed how quantum chemistry and quantum computing techniques can aid the different stages of drug design.

## COMMUNICATION AND OUTREACH

### Arts for Mental Health (ARTSMH)

October 2020 - Present

<https://www.artsmentalhealth.org/>

I am the Co-chairman, co-founder and treasurer of ARTSMH. ARTSMH is a student-led non-profit association. We hope to provide students who are interested in both the arts and mental health the opportunity to explore, experience, and learn together, as well as raising awareness of mental health issues.

### UCL ChangeMakers X ARTSMH

April 2021 - September 2021

*UCL ChangeMakers, Project Leader*

UCL, UK

Specific Role: Treasurer and data management

### Student-Led Volunteering Programme

April 2021 - Present

*UCL Student Union, Project Leader*

UCL, UK

Specific Role: Treasurer and data management

## RELEVANT CERTIFICATIONS & COURSES

**Certificates:** Google: IT Automation with Python; LinkedIn: C++ Essential Training; JuliaAcademy: Introduction to Julia; Microsoft: Azure AI Fundamentals (AI-900)

**Courses:** IOP Workshops (C++ & Julia); Wolfram Research Workshops: The Wolfram Language: Programming Fundamentals, Introduction to Machine Learning; Wolfram Summer School: Wolfram Language Training, Theories, Computations & Philosophies in Mathematics & Physics, Wolfram Science models and methods, Cellular Automata, Machine Learning & Neural Networks, Data Science

## TECHNICAL SKILLS

**Languages:** Intermediate: Python, Wolfram Language, MATLAB; Novice: C, C++, Julia, HTML, CSS, Java

**Tools:** Visual Studio Code, Jupyter Notebook, Wolfram Notebooks, Wolfram Mathematica, Wolfram Alpha, MATLAB R2021a, Git, GitHub, GitHub Desktop, Bash, Compiler-Explorer, Powershell, LAMMPS, WebMO, Avogadro

**Typesetting Documents:**  $\text{\LaTeX}$ , Microsoft Office

## LANGUAGES

English (Proficient)

Cantonese (Native)

Mandarin (Fluent)