# Lau Pak To (Ryan)

## CONTACT INFORMATION

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## EDUCATION

**University College London (UCL)** Starting in late September, 2022
MSc Physics

**University College London (UCL)** September 2019 - June 2022
BSc Natural Sciences (Major: Physics, Minor: Physical Chemistry)

- Overall: High Second Upper 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 Awards: Distinctions & Academic Awards in Physics & Mathematics; Maureen McDonnell Prize (Scholarship)

## RELEVANT RESEARCH EXPERIENCE

**Quantum Simulations of Antigen-Antibody reactions** July 2022 - Present
*Computational Biophysics & Quantum Technologies* Imperial College, UK
Supervisor: Dr. Henry Lee
Assisting a company to understand the interactions between antigen-antibody reactions on a gold nanoparticle surface using density matrix methods.

**Q-Wave: Simulating sound waves using Quantum Algorithms** June 2022 - Present
*Computational Physics & Quantum Technologies* UCL, UK
Supervisor: Dr. Reza Haqshenas
Applying the HHL algorithm to simulate sound-wave propagation by solving the Helmholtz equation and developing subsequent software for future therapeutic applications.

**Classifying Topological Phases of Quantum Matter using Tensor Networks** Sept 2021 - March 2022
*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* Wolfram Research / Wolfram Physics Project
Supervisor: Hatem Elshatlawy & Stephen Wolfram
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 (with a Staff Picked Featured Contributor Badge)

## WORK EXPERIENCE

**Private Tutoring** September 2022 - Present
*Notebook Tutors* Online, UK
Tutoring and supporting a student with the Natural Sciences Admissions Assessment (NSAA) on Mathematics and Chemistry.

**Research Intern** July 2022 - Present
*Quantum Simulations Internship* Imperial College, UK
Research Topic: Quantum Simulations of Antigen-Antibody reactions

**Research Intern** June 2022 - Present
*MAPS Summer Research Internship* UCL, MAPS, UK
Research Topic: Q-Wave: Simulating sound waves using Quantum Algorithms

**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

## TECHNICAL SKILLS

**Languages**: Intermediate: Python, Wolfram Language (Mathematica), MATLAB; Novice: C++, C, Julia, HTML, CSS, Java, QASM 2.0, C#

**Quantum Technologies/Platforms**: Qiskit, Cirq, myQLM, IBM Quantum Composer, IBM Quantum Lab, D-Wave Leap (Quantum Annealer)

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

**Typesetting Documents**: LaTeX, Microsoft Office, Google Docs

## SUMMER SCHOOL

**Qiskit Global Summer School 2022: Quantum Simulations** July 2022
*Quantum Technologies, Quantum Simulations* IBM, Online
https://qiskit.org/events/summer-school/
Participated in lectures, coding workshops and laboratory sessions on various quantum technologies.

**UCLQ Quantum Tech Summer School** July 2022
*Quantum Technologies* UCL & London Centre for Nanotechnology (LCN)
https://www.ucl.ac.uk/quantum/study-here/uclq-quantum-tech-summer-school
Participated in lectures, coding workshops and laboratory sessions on various quantum technologies.

**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)

## RELEVANT CERTIFICATIONS & COURSES

**Certificates:**
Google: IT Automation with Python; LinkedIn: C++ Essential Training; JuliaAcademy: Introduction to Julia; Microsoft: Azure AI Fundamentals (AI-900); IBM: Qiskit Global Summer School 2022 - Quantum Excellence (Advanced)
**Courses:** IBM Qiskit Global Summer School 2022: Quantum dynamics, simulations and methods, Noise in Quantum Hardwares, Quantum Chemistry; Quantum computational labs with Python; UCLQ Quantum Tech Summer School: Quantum Circuits and Error Correction, Quantum Algorithms, Software and Architechtures, Quantum Cryptography and Architectures, Laboratory work on quantum technologies and applications, coding workshops on IBM Quantum and D-Wave Quantum Annealer; 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

## 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

**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.

## 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 LaTeX within 48 hours. https://drive.google.com/drive/folders/1zf8b-X1uo8PzFvZiwtYG0lvUieJ02r5p?usp=sharing

## LANGUAGES

English (Proficient) Cantonese (Native) Mandarin (Fluent)

## 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 - June 2022
*UCL Student Union, Project Leader* *UCL, UK*
Specific Role: Treasurer and data management