



# Jian Hou LAI

## Curriculum Vitae

*Admiring the beauty of nature, which is shaped by physics, with the mathematical tools.*

### Description

I am interested in research in quantum mechanics, quantum field theory, and mathematics. My research experience includes quantum field theory in curved spacetime (bachelor's thesis) and Bose–Einstein condensates (internship project), complemented by active involvement in teaching and coaching high school students for competitive physics, including preparing Malaysia's national team for the International Physics Olympiad. I earned a B.Sc. (Hons) in Physics with a CGPA of 3.79/4.00 from the University of Science Malaysia.

### Education

- 2021–2025 **BSc. (Hons) Physics (Track: Pure Physics)**, UNIVERSITY OF SCIENCE MALAYSIA (USM), Penang, Malaysia.
  - **CGPA:** 3.79/4.00
  - **Thesis Title:** Probing an Expanding Universe with an Unruh-deWitt Detector
  - **Supervisor:** Dr. Wan Mhd. Husni Wan Mokhtar
- 2019–2021 **Sijil Tinggi Persekolahan Malaysia (STPM, A-Level Equivalent)**, SMK GAJAH BERANG, Melaka, Malaysia.
  - **CGPA:** 3.83/4.00 (3A 1B+) (Subjects: Physics, Mathematics, Chemistry, General Studies)
  - **English:** Malaysian University English Test (MUET) (187/300, Band 4)
- 2014–2018 **Sijil Pelajaran Malaysia (SPM, O-Level Equivalent)**, SMK MUNSHI IBRAHIM LABIS, Johor, Malaysia.
  - **Grades:** 4A+ 4A 1A- 1B+

### Research Experiences

- Jun. – Jul. 2025 **Review on Turbulence in 2D Bose-Einstein Condensation**, INSTITUTE OF ATOMIC AND MOLECULAR SCIENCE, Academia Sinica, Taiwan.
  - **Supervisor:** Dr. Hsiang-Hua Jen.
  - Studied Gross–Pitaevskii equation (GPE) and its role in describing condensates.
  - Reviewed quantum turbulence in BECs and its relation to classical turbulence (K41 and K62 theories).
  - Reviewed Spielman's experiment on 2D BEC turbulence and methods like time-of-flight and velocity structure functions.
- Sept. 2023 – Jun. 2024 **Probing an expanding universe with an Unruh-deWitt detector**, SCHOOL OF PHYSICS, University of Science Malaysia (USM), Malaysia.
  - **Supervisor:** Dr. Wan Mhd. Husni Wan Mokhtar
  - Analysed detector response in Minkowski and de Sitter spacetimes.
  - Applied derivative and non-derivative Unruh–deWitt detector (mathematical) models to calculate transition rates and interpret physical effects such as thermal-like responses in expanding universes.

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## Conference and Workshop Attended

- 12–13 Oct. 2024 **National Physics Undergraduate Project Conference 2024 (NPUPC2024)**, XIAMEN UNIVERSITY MALAYSIA (XMUM), Selangor, Malaysia.
- Presented my final year project at the conference and successfully won third place.
- May 2024 **Computational Skills for Physical Science (CSPS) Workshop Series 2024**, SCHOOL OF PHYSICS, USM, Penang, Malaysia.
- Contents covered: basic machine learning with orange, introduction to MATLAB.
- 28–30 Nov. 2023 **National Physics Conference 2023, Malaysia (PERFIK 2023)**, INSTITUT FIZIK MALAYSIA (IFM), Online.
- 13 Mar. 2023 **General Relativity Workshop**, PHYSICS COFFEE TALK USM, Online.
- 11 Jan. 2022 **New in Wolfram Language 13: Overview, Video Computation and Machine Learning**, WOLFRAM U, Online.
- 11 Nov. 2021 **Hands-on Start to Wolfram Mathematica**, WOLFRAM U, Online.

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## Extracurricular Activities

- Jul. 2022 – **President**, PHYSICAL SCIENCE SOCIETY USM.
- Jun. 2023
- Led 38 committees (including ExCo & Assistant ExCo), to support USM School of Physics students academically and build a stronger physics community.
  - Served as the representative for physics students, by liaising with higher authorities in the School of Physics.
  - The Physical Science Society successfully organised a total of 30 events within one academic session (avg one event per week), encompassing tours, series talks, academic workshops, sports, etc.
- Mar. – Oct. 2023 **Chairman**, NATIONAL PHYSICS UNDERGRADUATE PROJECT CONFERENCE 2023 (NPUPC2023).
- An initiative to provide a platform (competition) for Malaysia physics students to showcase their final year projects and foster the physics community in Malaysia.
  - Collaboration of Physics Societies from USM, University of Malaya (UM) and Xiamen University Malaysia (XMUM).
  - Organised the first on-site NPUPC at Xiamen University Malaysia.
  - Attracted participation of the physics community (around 100 people) from KL, Selangor, Penang, Negeri Sembilan, which includes different high school students, teachers, lecturers, experts, and others.
- Jul. 2022 – **Committee**, AGAPE CHRISTIAN SOCIETY USM.
- Jul. 2024
- Held two different positions in two academic sessions.
  - Organised physical gatherings with an average attendance of 20 members, where topical discussions and sharing sessions were conducted with the participants.
  - Led and moderated Bible study sessions within the Cell Group (Small Group), promoting critical thinking and active participation during the discussions.
  - Prepared Bible study materials for the 2023/2024 academic session.
  - Trained Cell Group Leaders to prepare themselves for leading the Cell Groups.
- Sept. 2022 – **Student Committee**, GLOBAL MALAYSIAN ASTRONOMERS CONVENTION – PENANG ROADSHOW.
- Jan. 2023
- As a student representative to partner with the School of Physics lecturers.
  - Partnered with USM Astronomy Club to lead several volunteers and committees to prepare and exhibit 2 astronomy-related booths during the event.
  - Engaged with more than 50 public participants for the booths.
- Sept. 2022 **Contestant**, NATIONAL STATISTICS COMPETITION, Mathematics Student Society, USM (Online).
- Nov. 2021 – **Assistant ExCo Academic**, PHYSICAL SCIENCE SOCIETY USM.
- Jul. 2022
- Assisted ExCo Academic by co-organising the Physics Coffee Talk (PCT) series (physics-related talk).
  - Hosted online PCT, "Everything You Need to Know About Multiverse" by a theoretical physicist from Xiamen University Malaysia and a hybrid  $\LaTeX$  workshop which is open to all USM Physics students.
  - Co-organised online open lecture on string theory, "String Theory and its Implications to 21st Century Mathematics" by an invited speaker from the National University of Singapore (NUS).
- Jan. – Jun. 2022 **Committee**, NATIONAL PHYSICS UNDERGRADUATE PROJECT CONFERENCE 2022 (NPUPC2022).
- Online conference (competition) with the collaboration of Physics Societies from USM, University of Putra Malaysia (UPM) and UM.

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## Working Experiences

- Sept. 2025 – **Online Part-time Tutor**, FRENZTALK.
- Present
- Subjects:** IGCSE Physics, STPM Mathematics–T & STPM Physics.

- Apr. – May 2025, **Intern**, DEPARTMENT OF MATHEMATICS, Xiamen University Malaysia (XMUM), Selangor, Malaysia.  
 Aug. – Sept. 2025
  - Presented weekly two-hour seminars on topics in quantum mechanics and quantum field theory, with a focus on the Standard Model.
  - Collaborated on and typed comprehensive notes to accompany the seminar presentations.
- Jun. – Jul. 2025 **Research Intern**, INSTITUTE OF ATOMIC AND MOLECULAR SCIENCES, Academia Sinica, Taiwan.  
  - Focus area:** Turbulence in 2D Bose-Einstein condensates.
  - Mentor:** Dr. Hsiang-Hua Jen.
  - Selected for a two-month Taiwan International Internship Program (TIIP) at Academia Sinica.
- Mar. 2021 – Apr. 2022 **Part-time Tutor**, ORBIT TUITION CENTER, Johor, Malaysia.  
  - Subjects:** STPM Mathematics–T, STPM Physics.

## Other Professional Experiences

- Jan. 2023 – Present **Coach**, MALAYSIA PHYSICS OLYMPIAD (OFM) TRAINING CAMP 2023 – 2026, Malaysia.  
  - Camp was organised by the committee of “Olimpiad Fizik Malaysia (OFM)” (Translated as “Malaysia Physics Olympiad”) to select and train the potential candidates to represent Malaysia in the International Physics Olympiad (IPhO).
  - Responsibilities include developing theoretical and practical questions for the screening test, conducting lectures ([my past online lectures can be found here!](#)), leading practical demonstrations, and problem-solving tutorials during the training camp.
  - Responsible for nominating qualified students.
- Oct. 2025 – June 2026 **Team Leader, Malaysia Team**, INTERNATIONAL SCIENTIFIC PHYSICS OLYMPIAD (ISPhO) 2026, Moscow, Russia.  
  - Responsible for training & guiding a group of high school students for ISPhO 2026, at Moscow Institute of Physics and Technology (MIPT).
- 3–10 Jun. 2024 **Observer, Malaysian Team 2 (AMISO)**, ASIAN PHYSICS OLYMPIAD, Perak, Malaysia.  
  - Organised by Asian Physics Olympiad committees at Tunku Abdul Rahman University (UTAR).
  - Involved as an observer to assist two team leaders in the discussions for theoretical and experimental papers, as well as in marking the participants' papers.
- 16 Dec. 2023 **Forum Moderator**, YOUTH STEM EXPERIMENT CAMP (YSEC) 2023, DISTED College, Penang, Malaysia.  
  - A student-led event organised by the Association of the Malaysian Alumni of the International Science Olympiads (AMISO) aims to help students explore hands-on experimental techniques in STEM.
  - Volunteered and partnered with another moderator in a two-hour forum, theme about 'Navigating the Global Landscape of STEM: Experiences, Opportunities, and Cultural Perspectives'.
  - Invited panellists from diverse expertise such as Math Olympiad medalist, R&D leader, RF expert, Assoc. Prof. in EE, and virtual participants with the NASA Hubble Fellowship and MIT Ph.D.

## Outreach & Public Engagement

- 20–22 Feb. 2024 **Kem Kecermelangan Olympiad Fizik 2024**, PULAU PINANG STATE EDUCATION DEPARTMENT, Penang, Malaysia.  
  - Known as “Physics Olympiad Excellence Camp 2024”.
  - Delivered topics regarding competitive physics and engaged in experimental training.
- 28 Oct. 2023 **Physics Interaction Day – “The Inception”**, PHYSICAL SCIENCE SOCIETY USM, Penang, Malaysia.  
  - Shared experiences as a senior with USM physics juniors ( 15 participants).

## Awards & Honours

- 2021–2025 **Dean’s List Academic Award** *Recognition of outstanding academic performance by School of Physics USM*
- 2024 **Silver Medal, The University Physics Competition** *Team 159, Top 2.2–17% out of 681 teams (International)*
- 2022 **Prize of Honour (Hadiah Kepujian)** *Recognition of achieving a perfect GPA (4.00) in Semester 1, Academic Session 2021/2022 by USM*
- 2022 **Kuok Foundation Study Award** *3 years of loan-grant award of RM14,000.00 per academic year*
- 2021 **Selected to represent IPhO Malaysia Team** *After competing in multiple selection tests*
- 2020 **Honorable Mention, Kangaroo Math Competition**

## Computing Skills

Intermediate Python,  $\text{\LaTeX}$ , Microsoft Word, Microsoft Excel, Wolfram Mathematica  
Elementary MATLAB, Orange

## Membership

2024–Present **Malaysian Physics Institute (IFM)** *Student Member*  
2023–Present **Kuok Foundation Scholars Club Malaysia** *Member*

## Languages

Mothertongue **Chinese** *High proficiency in reading, writing and speaking*  
Advanced **English** *High proficiency in reading, writing and speaking*  
Intermediate **Malay** *Intermediate proficiency in reading, writing and speaking*

## References

A/Professor **Iskandar Shahrim Mustafa**, DEPUTY DEAN (ACADEMIC, CAREER & INTERNATIONAL), SCHOOL OF PHYSICS, USM, Penang, Malaysia.  
Dr. 

- Relationship: Advisor of Physical Science Society, Session 2022/2023.
- Contact: [iskandarshah@usm.my](mailto:iskandarshah@usm.my)

A/Professor **Yoon Tiem Leong**, ASSOCIATE PROFESSOR, SCHOOL OF PHYSICS, USM, Penang, Malaysia.  
Dr. 

- Relationship: Academic Advisor.
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