

# Shao-Kai Jonathan Huang

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## SUMMARY

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I am an undergraduate student of Physics and Mathematics at National Taiwan University interested in the interplay between physics and life. I have spent a winter at the Mathematics Department of the University of Waterloo, Ontario, and will spend 2026 summer at the Santa Fe Institute, New Mexico. I love, and have been, working with others to explore interdisciplinary topics at the frontier of science.

## RESEARCH DIRECTION

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Biophysics, complex systems theory, statistical physics, ML and DL in computation

## PUBLICATIONS & AWARDS

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- **First Place**, NTU Physics Experiment Design Contest. Topic: experimental model of the phone book friction phenomenon.

## RESEARCH PROJECTS

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- **Research Internship: Santa Fe Institute Undergrad Complex Research**  
2026 May. - Aug. as **Undergraduate Complex Research Intern** at the Santa Fe Institute, New Mexico. Advisor: TBD. Fully funded 10-week complex systems theory research. My topic of research was .
- **Project: Stochasticity in Single-Cell Metabolism and Regulation**  
2026 Jan. - Present as **Undergraduate Research Student** in the Department of Applied Mathematics, UWaterloo. Advisor: Professor Matthew Scott. We studied and modeled the stochasticity in cells, in particular growth and metabolism on the single-cell level, and recovered important experimental observations.
- **Project: Scalable Reaction Networks (SRNs) and Proteome Partition**  
2025 Jan. - Present as **Undergraduate Research Student** in the Institute of Molecular Biology, Academia Sinica. Advisor: Dr. Wei-Hsiang Lin. We formulated the classic proteome partition by Scott et al. (2010) in the SRN framework, and obtained some novel analytical results.
- **Project: Femtosecond Nonlinear Optical Lab ([Link to Demo](#))**  
2025 Sep. - 2026 May. as **Undergraduate Research Student** in the Quantum Light Matter Lab in NTU Physics. Advisor: Professor Chaw-Keong Yong. I constructed a noncollinear OPA device for high-precision ultrafast experiments probing exciton dynamics. Extensive experience working with optics was gained.
- **Research Internship: CNN For HET ([Link to Demo](#))**  
2025 Jul. - Sep. as **Undergraduate Summer Intern** in the Institute of Physics, Academia Sinica. Advisor: Dr. Anatoli Fedynitch. Deep learning (convolutionary neural network) methods are used to make physical predictions based on Monte Carlo simulations and large datasets obtained from a high energy theory (HET) model of ultra-high-energy cosmic rays. Extensive programming, git, and hand-on DL experiences were gained.
- **Bookclub: Multiple Time Scale Dynamics**

2025 Dec. - 2026 Feb. as **Participant and Presenter** in the NTU Math 2026 Winter Bookclub. Host: Professor Tai-Chia Lin, NTU Department of Mathematics. The topic of study was multiple time scale dynamics in ordinary differential equations. Each week, we prepared a presentation on an assigned section of the book.

## ACADEMIC PRESENTATIONS / WRITTEN MATERIALS

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- **Conference Talk: Scalable Reaction Networks and Proteome Partition**

2026 May. as **Presenter** at the 2026 Quantitative Microbiology Symposium in the Institute of Molecular Biology, Academia Sinica. I presented a poster and gave a short talk on my novel research on proteome partition theory.

- **Guest Talk: A Biophysical Theory of Proteome Partition**

2026 Apr. as **Presenter** in the Scott and Ingalls Lab at the University of Waterloo. I presented to the lab results from my work with Dr. Wei-Hsiang Lin on the analytical theory of proteome partition, as well as my numerical work with Professor Scott.

- **Conference Talk: CNN for High Energy Physics Theory**

2025 Oct. as **Presenter** at the 2025 TADAML (Data Analysis and Machine Learning) Conference in the Institute of Physics, Academia Sinica. I presented results from my summer internship to experts in ML and DL for the Telescope Array.

- **Attended Conferences: 2026 APS Global Summit / 2026/2025 Quantitative Microbiology Symposium / 2025 Symposium of Complex Systems / Frontiers in Theoretical and Quantitative Biophysics @NCTS**

Attended with theoretical group members and PI Dr. Wei-Hsiang Lin.

## RELEVANT COURSES

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**Density Functional Theory (A+)**

PHYS GRAD

Final Presentation on geometry-independent DFT for Van der Waals Interaction.

**Quantum Field Theory I (A+) & II (A+)**

PHYS GRAD

Final Presentation on the statistical field theory formulation of percolation theory.

**Fundamentals of Physics Experiment (A+)**

PHYS

Presented our extensive work on building the NOPA device.

**Mathematical Foundations of Machine Learning and Data Analysis (A)**

MATH GRAD

**Intro to Dynamical Systems and Chaos (completed)**

Santa Fe Institute (online)

**Introduction to Biophysics**

UWaterloo (ongoing)

**Computer Modeling of Cellular Systems**

UWaterloo (ongoing)

## EDUCATION

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2026 Jan. - Apr.	Undergraduate Exchange in Math, <b>University of Waterloo</b>	(exchange)
2023 - present	Physics Undergrad, <b>National Taiwan University</b>	(GPA: 4.17/4.30)
2024 - present	Mathematics Undergrad, <b>National Taiwan University</b>	(Double major)
2024 - present	EE Undergrad, <b>National Taiwan University</b>	(minor)
2020 - 2023	<b>Taipei Municipal Chien-Kuo High School</b>	(Grades: graduated first of class. Mayor's Award, 1% school wide)

## SKILLS, QUALIFICATIONS, AND LEADERSHIP

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Programming	Proficient in Python, MATLAB, with experience in C++, Julia, Mathematica
ML and Data Analysis	TensorFlow for DL and ML, Qiskit for quantum computing simulation
English Proficiency	IELTS 8.5/9.0 (Apr. 2025)
Scientific Portfolio	Comprehensive L <sup>A</sup> T <sub>E</sub> X notes and research logs on my <a href="#">personal site</a> .
Leadership	Student Association of NTU Physics as Vice Officer of Academic Affairs; 2025 NTU Azalea Festival as Organizer; student-faculty talks as Co-Organizer; part of the UChicago-Taiwan Exchange Program (UCTS) Organizing Team; 2024 Wu Chien-Hsiung Science Camp as Camp Counselor
Community Service	International Companions for Learning (ICL) at NTU Physics; 7 tutor students in high school level competition physics (IPhO, TPhO), AP, calculus, classical analysis