

Cun Wei Liu

✉ cl3762@columbia.edu | 🌐 <https://lufferacademy.netlify.app> | 📱 Lufter

Research Interests

Quantum Information, Quantum Simulation, Computer Simulating Physics, Applications of Machine Learning in Material Design.

Education

Columbia University

M.S. IN APPLIED PHYSICS

- Incoming student

New York, NY

09/2021-PRESENT

National Cheng Kung University (NCKU)

B.S. IN CIVIL ENGINEERING

- Overall GPA: 3.55/4.3, Physics Core: 4.16/4.3
- Courses: Physcis (Quantum Physics I&II, Electromagnetism I&II, Solid State Physcis), Computational Science, Engineering, Material Science

Tainan, Taiwan

06/2020

Research Experience

Research Assistant , Physics Dept. Matterwave Lab, Prof. Pei Chen Kuan

Tainan, Taiwan

MULTIPLE WAY QUANTUM WALK (MWQW)

08/2019 - PRESENT

- Explored the potential of simulating Dirac Cellular Automata and through MWQW by revocering the Hamiltonian.
- Examined the error tolerance when implementing MWQW on AMO apparatus by analytical and numerical methods.
- Discussed charateristic of the modification of MQWQ when simulating quantum topological phases.

SENSITIVE MEASUREMENTS THROUGH MATTER WAVES.

- Research on implementing double-diffraction Bloch oscillation to cancel the phase perterbation when performing sensitive measurements.

Research Assistant, Civil Engineering Dept. AI Material Lab, Prof. Yun Che Wang

Tainan, Taiwan

MACHINE LEARNING IN MATERIAL DESIGN. [APCOM2019] [CTAM44][MLDT2021][USNCCM16]

02/2019 - 06/2020

- Applied generative adversarial networks (GAN) to generate high fidelity microstructure images.
- Proposed regression VGG networks (rVGG) that can predict mechanical properties from material images with 95% accuracy.
- Outperformed Finite Element Methods (FEM) in predicting time over 100 times.
- Investigated a Bayesian-optimization model that can fine-tune GAN-generated microstructure geometry through the rapid-labeling rVGG.

CONSTRUCTING HOMOGENOUS MATERIALS UNSING COMPUTATIONAL METHODS.

- Implemented pruning protocol on 96-core CPUs to generate auxetic networks inspired by "Auxetic metamaterials from disordered networks".
- Implemented a stochastic protocol to produce large scale homogenous microstructure datasets by two-point correlation function.

Publication

- [1] Chun Wei Liu, Pei Chen Kuan, "Symmetric Quantum Walk With Phase Transition Feature". (In preparation).
- [2] Yun-Che Wang, Chun Wei Liu, Tsai-Wen Ko, "Optimization of Chiral Metamaterials via Deep Neural Networks", 16th U.S. National Congress on Computational Mechanics (USNCCM16), 2021.
- [3] Yun-Che Wang, Chun Wei Liu, Tsai-Wen Ko, "Using Deep Neural Networks to Generate Hierarchical Metamaterials for Enhanced Mechanical Properties", Mechanistic Machine Learning and Digital Twins for Computational Science, Engineering and Technology (MMLDT), 2021.
- [4] Yun-Che Wang, Chun Wei Liu, Pei-Chen Cheng, Jyun-Ping Wang, Tsai-Wen Ko "Design of Chiral Metamaterials via Deep Neural Networks", 44th National Conference on Theoretical and Applied Mechanics (CTAM44), 2020.

Honors & Awards

- 2020 **Chairman Special Award (entering final round)**, IBMq Qiskit Hackathon Taiwan
- 2018 **5th Place (out of 250 students)**, Asia Pacific Mechanics Contest for College Students
- 2017 **Dean's list** , GPA in top 5% of the department

Presentation

Design of Viscoelastic Auxetic Materials Through Machine Deep Learning [Link](#)

Taipei, Taiwan

ASIAN PACIFIC CONGRESSON COMPUTATIONAL MECHANICS (APCOM2019)

12/2019

- Discussed the use of VGG networks as an alternative of Finite Element Methods (FEM) when labeling mechanical properties for microstructures.

Selected Projects

Predicting Handwriting Recognition With Parametrized Quantum Circuit [Link](#)

Xitou, Taiwan

FOR IBMQ QISKIT HACKTHON TAIWAN 2020

09/2020

- Implemented 4qubit-Ry gate circuits in predicting MNIST dataset with the learning curve converged after ten iterations.
- Analized the potential in predicting molecular ground state energies with Quantum LSTM Meta-Learner and VQE.

Skills

Languages: Python **Libraries/Tools:** MATLAB, Qiskits, Mathematica, PyTorch **Other Technologies:** GNU/Linux, Raspberry Pi, Git, LAMMPS, 编程