Chun Wei **Liu**

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Education

Columbia University *New York, NY*

M.S. in Applied Physics *09/2021-PRESENT*

- Courses: Quantum Optics, Condensed Matter Physics, Laser Physics, Semiconductor Physics and Device Microfabrication

National Cheng Kung University (NCKU) *Tainan, Taiwan*

B.S. in Civil Engineering *06/2020*

- Overall GPA: 3.55/4.3, Physics Core: 4.16/4.3
- Courses: Quantum Physics, Electromagnetism, Machine Learning, Material Science and Engineering, Mechanics of Materials, Automata

Research Experience

***Research Assistant* , Physics Dept. Will Lab,** Prof. Sebastian Will *New York, NY*

TweeSr - Programmable Atomic Tweezer Arrays [**DAMOP2022**] *09/2021 - PRESENT*

- Developing algorithms for atom-rearranging during tweezer array loading with high filling rate and with linear scaling.
- Constructing a multiplexing laser-optics system with stable PID control backend and sharp user-interface frontend.
- Building 3D MOT that successfuly trapping Strontium atoms for further quantum simulation applications.

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

Quantum Walks *08/2019 - 08/2021*

- Investigated spatial search algorithms powered by quantum walk protocols.
- Otained analytica and numerical solutions for the evolution of an engineered quantum walk Hamiltonian.
- Explored the potential of quantum simulating Quantum Cellular Automata through discrete time quantum walks.

***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.
- Adapted the 19-layer VGG networks (VGGNet) that can predict mechanical properties from material images with 95% accuracy.
- Simulating mechanical properties of microstructor samples via Finite Element Methods (FEM) softwares.
- Investigated a Bayesian-optimization model that can fine-tune GAN-generated microstructure geometry through the rapid-labeling rVGG.

Constructing homogenous materials unsing computational methods.

- Applied multiprocessing on molecular-simulation to generate auxetic networks with 40 times better computational efficiency.
- Implemented a stochastic protocol to produce large scale homogenous microstructure datasets by two-point correlation function.

Publication

[1] *Chun Wei Liu*, Pei Chen Kuan, *"Coherent localization in quantum walks"*. (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, LaTeX