

Shu Fay Ung

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Education

- **Columbia University** **New York, NY**
Ph.D. Chemical Physics *Expected May 2026*
 - Advisor: David Reichman
- **Columbia University** **New York, NY**
M.A. Chemical Physics *May 2023*
 - Cumulative GPA: 4.1
- **California Institute of Technology** **Pasadena, CA**
B.Sc. Physics *June 2021*
 - Advisor: Garnet Chan
 - Cumulative GPA: 4.0

Research Experience

- **Graduate Researcher, Columbia University** **New York, NY**
Advisor: David Reichman *August 2021 – Present*
 - Studying strongly-correlated electronic states in moiré materials, particularly in twisted bilayer transition metal dichalcogenides.
- **Research Fellow, Harvard University** **Cambridge, MA**
Advisor: Joonho Lee *July 2024 – September 2024*
 - Studied topological phases in rhombohedral pentalayer graphene in collaboration with Ashvin Vishwanath's group.
- **Undergraduate Researcher, Caltech** **Pasadena, CA**
Advisor: Garnet Chan *October 2019 – August 2021*
 - Developed a spin-projected perturbation theory (MP2) method for electronic structure calculations.
- **Undergraduate Researcher, Caltech** **Pasadena, CA**
Advisors: Peter Love (Tufts University), John Preskill *June 2019 – August 2019*
 - Worked on term reduction techniques (e.g. unitary partitioning) for solving electronic structure Hamiltonians via variational quantum algorithms.
 - Worked to extend the OpenFermion software library to include plane wave basis and plane wave dual basis electronic structure Hamiltonians for (i) non-periodic 3D systems, and (ii) periodic and non-periodic 2D systems.
- **Undergraduate Researcher, Caltech** **Pasadena, CA**
Advisor: Maria Spiropulu *June 2018 – March 2019*
 - Analyzed data from the CMS detector at the Large Hadron Collider (LHC) to obtain exclusion limits on the parameters of the hypothesized dark photon.
 - Simulated the decay of dark photons to dimuons and the detector response using the CMS Software Framework (CMSSW).

Awards and Honors

- 2022-2023 Jack Miller Teaching Award
- 2022-2023 Blanche R. and David Kasindorf Fellowship Fund in Physical Chemistry, Columbia University
- 2020 Donald and Trudy Bergen Math Scholarship, Caltech
- 2020 John Stauffer SURF Fellowship, Caltech
- 2017, 2018, 2019 Wylie Endowed Scholarship, Caltech
- 2017 Pearson Outstanding Learner Awards - Highest Mark in Malaysia for A Level Further Mathematics

Publications and Preprints

- [4] T. Jiang, M.K.A. Baumgarten, P.F. Loos, A. Mahajan, A. Scemama, **S.F. Ung**, J. Zhang, F.D. Malone, J. Lee. *Improved modularity and new features in ipie: Toward even larger AFQMC calculations on CPUs and GPUs at zero and finite temperatures.* J. Chem. Phys. 161, 162502 (2024), [arXiv:2406.16238](#)
- [3] **S.F. Ung**, J. Lee, D.R. Reichman. *Competing Generalized Wigner Crystal States in Moiré Heterostructures.* Phys. Rev. B 108, 245113 (2023), [arXiv:2308.03020](#)
- [2] R. Babbush, W.J. Huggins, D.W. Berry, **S.F. Ung**, A. Zhao, D.R. Reichman, H. Neven, A.D. Baczewski, and J. Lee. *Quantum simulation of exact electron dynamics can be more efficient than classical mean-field methods.* Nat. Commun. 14, 4058 (2023), [arXiv:2301.01203](#)
- [1] A. Zhao, A. Tranter, W. Kirby, **S.F. Ung**, A. Miyake, and P.J. Love. *Measurement reduction in variational quantum algorithms.* Phys. Rev. A 101, 062322 (2020), [arXiv:1908.08067](#)

Talks

- *Competing Generalized Wigner Crystal States in Moiré Heterostructures.* Contributed talk at APS March Meeting. 03/2024
- *Competing Generalized Wigner Crystal States in Moiré Heterostructures.* Invited talk at MRSEC IRG Symposium, Columbia University. 11/2023
- *Competing Generalized Wigner Crystal States in Moiré Heterostructures.* Invited talk at Physical Chemistry Seminar, Columbia University. 09/2023
- *Competing Generalized Wigner Crystal States in Moiré Heterostructures.* Invited talk at Joonho Lee's group, Harvard University, 08/2023
- *Spin-Symmetry Restored Many-Body Perturbation Theory.* SURF Seminar Day, Caltech, 10/2020
- *Representation of Molecular Wavefunctions with Plane Wave Bases.* SURF Seminar Day, Caltech. 10/2019

Mentoring and Teaching Experience

- **Volunteer Mentor and Facilitator** **Malaysia**
USAPPS *September 2020 – Present*
 - Provide guidance for Malaysian students applying to U.S. colleges and volunteered for the annual USAPPS workshops.
- **Teaching Assistant**
Columbia University & Caltech
 - Columbia University, *August 2021 – December 2023*
 - CHEMGU 4230: Statistical Thermodynamics (Graduate)
 - CHEMUN 1500: General Chemistry Lab (Undergraduate)
 - CHEMUN 1507: Intensive General Chemistry Lab (Undergraduate)
 - Caltech, *January 2020 – March 2020*
 - Ph 6: Physics Laboratory (Undergraduate)

Skills

- **Natural languages** English (native), Mandarin (native), Malay (Limited working proficiency)
- **Programming languages** Python, C++, Q#, Bash, \LaTeX
- **Scientific software** pySCF, Q-Chem, ipie, Qiskit
- **Miscellaneous** Adobe Suite (Illustrator, InDesign, Photoshop, Lightroom)