# Chih-Chun Wang

Hokkien: Tīkun Ông  Informally: Michael

*Researcher*

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## EDUCATION

2023–2025 **Master of Science in Theoretical and Mathematical Physics**, *Technical University of Munich & Ludwig-Maximilians-Universität München*, Germany
**Overall grade:** 1.0
**Thesis title:** *Geometry of Generalized Density Functional Theories* (arXiv:2511.14822)
**Selected coursework:** Lie Groups and Representations, Differential Geometry, Riemannian Geometry, Mathematical Gauge Theory.

2019–2022 **Bachelor of Science in Physics**, *National Tsing Hua University*, Taiwan
**Honors:** Honorary Graduate Certificate of Merit (ranked 1st of 69).

## RESEARCH INTERESTS

**Core Methodology:** Geometric Deep Learning: identifiability, expressivity and algebraic geometry of equivariant architectures; trade-offs between imposed and learned equivariance.
**AI for Science:** (1) Symmetry and geometric structure in models for molecular and materials data. (2) Machine learning DFT exchange-correlation functionals.
**Physics & Vision:** Gauge-theoretic and symmetry-based methods for vision and scientific data.

## RESEARCH EXPERIENCE

2026–Present **Research Collaborator**
Ongoing collaboration of six contributors, begun at LOGML 2026 and mentored by Simone Foti (Imperial College London) and Massimiliano Esposito (IBM Research Europe).
- Anisotropic geodesic convolutions on the sphere for data-driven weather modeling.
- Feature aggregation by parallel transport along geodesics, equivariant to the choice of frame.

2026–Present **Research Collaborator**
Ongoing collaboration with Georg Bökman (AMLab)
- Development of equivariant vision transformers for finite symmetry groups.
- Gauge-theoretic construction of equivariant layers.
- Investigation of gradual symmetry breaking.

2025–Present **Researcher**, *Ludwig-Maximilians-Universität München*, Germany
Geometry of generalized density functional theories.
- Generalization of density functional theory for finite-dimensional Hilbert spaces.
- Application of symplectic geometry, representation theory, and convex analysis to derive properties of the universal functional.

2022–2023 **Research Assistant**, *National Cheng Kung University*, Taiwan
Developed and trained large-window vision transformers for structural-damage segmentation in civil infrastructure.

2020–2022 **Teaching Assistant**, *National Tsing Hua University*, Taiwan
Exercise tutorials and grading for Applied Mathematics, Nonlinear Dynamics and Chaos, and Thermal and Statistical Physics.

2019–2022 **Undergraduate Research Assistant**, *National Tsing Hua University*, Taiwan
- Ginzburg-Landau theory of solid-liquid interfaces.
- Topological properties of the 2-dimensional local Kuramoto model.

## TECHNICAL SKILLS

Programming: Python, C++, Java
Deep Learning: PyTorch, PyTorch Geometric

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|---|---|
| MLOps | MLflow, Hydra, PyTorch Lightning |
| Systems | Git, Linux, SLURM |
| Mathematics | Working knowledge of group theory, representation theory, differential geometry, and gauge theory |

## PUBLICATIONS

2026 **Tīkun Ông** & Georg Bökman. "Inherent Trade-offs when Enforcing Correct Data Symmetries in Multi-head Self-attention". arXiv:2608.30417v2 (under review at ICLR 2027).
Single-author extended abstract, NeurReps, NeurIPS 2026 Workshop (Oral).

2026 **Tīkun Ông** & Georg Bökman. "A Unified Framework for Vision Transformers Equivariant to Discrete Subgroups of $\mathrm{O}(2)$". arXiv:2606.27864 (NeurReps, PMLR).

2026 **Chih-Chun Wang**, Julia Liebert, Markus Penz & Christian Schilling. "Unified Framework for Functional Theories of Quantum Systems". arXiv:2606.06676 (minor revision, *J. Math. Phys.*).

2026 **Chih-Chun Wang** & Christian Schilling. "A Geometric Approach to Strongly Correlated Bosons: From $N$-Representability to the Generalized BEC Force". *Phys. Rev. B* 113 224511.

2023 **Chih-Chun Wang** & Kuo-An Wu. "One-mode Ginzburg-Landau Theory of Surface Energy Anisotropy". *Phys. Rev. B* 107 144101.

## SCHOLARSHIPS & AWARDS

2023–2025 DAAD Scholarship (Tsung Cho-Chang Education Foundation) (€22,856)

2022 Chu Shun-I Scholarship (NT$100,000)

2021 Mei Yi-Chi Scholarship (NT$100,000)

2021 National Tsing Hua University Academic Achievement Award

## CONFERENCES, WORKSHOPS, AND PRESENTATIONS

### *Talks*

2026 "Boundary Force in Generalized Density Functional Theories." *Workshop on the Foundations and Extensions of Density-Functional Theory*, Oslo (April).

2022 "One-mode Ginzburg-Landau Theory of Surface Energy Anisotropy." *American Physical Society March Meeting*, Chicago (March).

### *Posters*

2026 "Unified Framework for Vision Transformers Equivariant to Discrete Subgroups of $\mathrm{O}(2)$." *London Geometry and Machine Learning*, London (July).

2026 "$D_6$-Equivariant Vision Transformer on a Hexagonal Lattice." *Workshop on Polyhedral Geometry for Neural Networks*, Nuremberg (March).

2025 "Geometry of Strongly Correlated Bosons." *Munich Conference on Quantum Science & Technology*, Kufstein (June).

## ACADEMIC SERVICE

### *Organization*

2026 *Geometric Viewpoints on Learning, Data, and Neural Networks*, Munich (September). https://munichgeoml.github.io/

### *Reviewing*

2026 Reviewer, *NeurIPS Workshop on Symmetry and Geometry in Neural Representations* (NeurReps).

2026–Present Reviewer, *zbMATH Open*.

## LANGUAGES

**English** (Fluent) | **Spanish** (Fluent) | **Mandarin** (Native) | **German** (B2)