Mao Tian TAN, Ph.D.

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Education

2015 – 2021   **Ph.D., Physics, The University of Chicago**
Thesis title: *Quantum Entanglement and Quantum Chaos in Field Theory and Many-Body Physics.*
Advisor: Shinsei Ryu

2015 – 2016   **M.S., Physics, The University of Chicago**

2014 – 2015   **M.Sc., Physics, University of Waterloo**

2010 – 2014   **B.Sc., Physics, National University of Singapore**
Second Major: Mathematics

Work Authorization

Eligible for H1B1 visa as a Singaporean citizen, a streamlined process with a dedicated quota that is rarely met, making hiring straightforward for employers.

Employment History

2025 – · · · ·   **Research Assistant,** University of Ljubljana.

2022 – 2024   **Young Scientist Training Program Postdoctoral Fellow,** Asia Pacific Center for Theoretical Physics.

2021 – 2022   **Postdoctoral Associate,** New York University, Department of Physics.

Grants And Fellowships

2022-2024   Obtained an independent postdoctoral fellowship at the Asia Pacific Center for Theoretical Physics that comes with an annual research budget of approximately US$3700 to be used at my own discretion.

Service

2024   Reviewed a manuscript for Physics Letters A.

2023   Chaired a session on "Quantum many-body systems and quantum fluids" at the 28th International Conference on Statistical Physics, Statphys28.

     Reviewed a manuscript for Journal of High Energy Physics.

2021   Reviewed a manuscript for Nuclear Physics, Section B.

Research Publications

Bibliography

1. K. Goto, M. Nozaki, S. Ryu, K. Tamaoka, and M. T. Tan, "Non-equilibrating a black hole with inhomogeneous quantum quench," *Journal of High Energy Physics*, vol. 2025, no. 8, p. 186, Aug. 2025, ISSN: 1029-8479. DOI: 10.1007/JHEP08(2025)186.

2. J. Kudler-Flam, M. Nozaki, T. Numasawa, S. Ryu, and M. T. Tan, "Bridging two quantum quench problems — local joining quantum quench and möbius quench — and their holographic dual descriptions," *Journal of High Energy Physics*, vol. 2024, no. 8, p. 213, Aug. 2024, ISSN: 1029-8479. DOI: 10.1007/JHEP08(2024)213.

3. W. Mao, M. Nozaki, K. Tamaoka, and M. T. Tan, "Local operator quench induced by two-dimensional inhomogeneous and homogeneous cft hamiltonians," *Journal of High Energy Physics*, vol. 2024, no. 7, p. 200, Jul. 2024, ISSN: 1029-8479. DOI: 10.1007/JHEP07(2024)200.

4. M. Nozaki, K. Tamaoka, and M. T. Tan, "Inhomogeneous quenches as state preparation in two-dimensional conformal field theories," *Phys. Rev. D*, vol. 109, p. 126 014, 12 Jun. 2024. DOI: 10.1103/PhysRevD.109.126014.

5. K. Goto, M. Nozaki, S. Ryu, K. Tamaoka, and M. T. Tan, "Scrambling and recovery of quantum information in inhomogeneous quenches in two-dimensional conformal field theories," *Phys. Rev. Res.*, vol. 6, p. 023 001, 2 Apr. 2024. DOI: 10.1103/PhysRevResearch.6.023001.

6. M. T. Tan, Y. Wang, and A. Mitra, "Topological defects in Floquet circuits," *SciPost Phys.*, vol. 16, p. 075, 2024. DOI: 10.21468/SciPostPhys.16.3.075.

7. K. Goto, M. Nozaki, K. Tamaoka, and M. T. Tan, "Entanglement dynamics of the non-unitary holographic channel," *Journal of High Energy Physics*, vol. 2023, no. 3, p. 101, Mar. 2023, ISSN: 1029-8479. DOI: 10.1007/JHEP03(2023)101.

8. K. Goto, A. Mollabashi, M. Nozaki, K. Tamaoka, and M. T. Tan, "Information scrambling versus quantum revival through the lens of operator entanglement," *Journal of High Energy Physics*, vol. 2022, no. 6, p. 100, Jun. 2022, ISSN: 1029-8479. DOI: 10.1007/JHEP06(2022)100.

9. I. MacCormack, M. T. Tan, J. Kudler-Flam, and S. Ryu, "Operator and entanglement growth in nonthermalizing systems: Many-body localization and the random singlet phase," *Phys. Rev. B*, vol. 104, p. 214 202, 21 Dec. 2021. DOI: 10.1103/PhysRevB.104.214202.

10. J. Kudler-Flam, M. Nozaki, S. Ryu, and M. T. Tan, "Entanglement of local operators and the butterfly effect," *Phys. Rev. Res.*, vol. 3, p. 033 182, 3 Aug. 2021. DOI: 10.1103/PhysRevResearch.3.033182.

11. M. T. Tan and S. Ryu, "Particle number fluctuations, rényi entropy, and symmetry-resolved entanglement entropy in a two-dimensional fermi gas from multidimensional bosonization," *Phys. Rev. B*, vol. 101, p. 235 169, 23 Jun. 2020. DOI: 10.1103/PhysRevB.101.235169.

12. J. Kudler-Flam, M. Nozaki, S. Ryu, and M. T. Tan, "Quantum vs. classical information: Operator negativity as a probe of scrambling," *Journal of High Energy Physics*, vol. 2020, no. 1, p. 31, Jan. 2020, ISSN: 1029-8479. DOI: 10.1007/JHEP01(2020)031.

13. L. Nie, M. Nozaki, S. Ryu, and M. T. Tan, "Signature of quantum chaos in operator entanglement in 2d cfts," *Journal of Statistical Mechanics: Theory and Experiment*, vol. 2019, no. 9, p. 093 107, Sep. 2019. DOI: 10.1088/1742-5468/ab3a29.

Presentations

Conference Presentations

2023   **Information Scrambling and Recovery in Inhomogeneous Quenches: An Exploration in Two-dimensional Conformal Field Theories**
Contributed talk at *the 28th International Conference on Statistical Physics, Statphys28*, the University of Tokyo, Japan.

Presentations (continued)

2021   **Entanglement of Local Operators and the Butterfly Effect**
Presentation at *APS March Meeting*.

Workshop Presentations

2024   **The dynamics of entanglement under inhomogeneous quenches in two-dimensional conformal field theories**
Contributed talk at *Novel Emergent Phenomena in Quantum Many-Body Dynamics* workshop, Les Houches School of Physics, France.

2023   **Information Scrambling and Recovery in Inhomogeneous Quenches: An Exploration in Two-dimensional Conformal Field Theories**
Contributed talk at the *ExU-YITP Conference "Quantum Information and Theoretical Physics"*, Yukawa Institute for Theoretical Physics, Kyoto University, Japan.

   Information Scrambling and Recovery in Inhomogeneous Quenches: An Exploration in Two-dimensional Conformal Field Theories
Contributed talk at the *YSF-YITP Symposium: Perspectives on Non-Equilibrium Statistical Mechanics*, Yukawa Institute for Theoretical Physics, Kyoto University, Japan.

   Inhomogeneous Quenches in Two-dimensional Conformal Field Theories
Gong show talk at the *Entanglement, Large N and Black Hole* workshop, APCTP, Pohang, South Korea.

Seminars

2022   **Operator Entanglement as a Probe of Information Scrambling and Quantum Chaos**
Center for Quantum Phenomena, New York University.

2021   **Operator Entanglement as a Probe of Information Scrambling and Quantum Chaos**
Institut Quantique, Université de Sherbrooke, Quebec, Canada.

   Operator Entanglement as a Probe of Information Scrambling and Quantum Chaos
Institute for Theoretical Physics, University of Cologne, Germany.

   Operator Entanglement as a Probe of Information Scrambling and Quantum Chaos
Pennsylvania State University, State College, PA.

2020   **Operator Entanglement as a Probe of Information Scrambling and Quantum Chaos**
Jozef Stefan Institute in Ljubljana, Slovenia.

   Operator Entanglement as a Probe of Information Scrambling and Quantum Chaos
Seminar at Yale University, New Haven, CT.

Poster Presentations

   Entanglement of Local Operators and The Butterfly Effect
Dynamics, criticality, and universality in random quantum circuits workshop.

Presentations (continued)

2018 **Entanglement Entropy and Related Quantities of a 2d Fermi Liquid via Multidimensional Bosonization**
UIUC-UChicago meeting, Department of Physics, University of Chicago, IL.

Teaching

2015 – 2019 **Teaching Assistant, The University of Chicago.**
Teaching assistant for undergraduate courses: Classical Mechanics, Quantum Mechanics 1, Statistical Mechanics, Honors Freshman Physics. Conducted discussion and laboratory sessions with undergraduates.

2016 **Nominated for the Physical Sciences Teaching Prize.**

Skills

Coding Python, Matlab, Mathematica and C.

Certificates

2025 **Quantum Computing Foundations**
Completed an online course offered by QuantGates which covers the basics of quantum computing, culminating in the implementation of the Quantum Approximate Optimization Algorithm (QAOA) using Qiskit in Python.

2024 **Deep Learning Specialization**
Completed all five Coursera courses: *Neural Networks and Deep Learning*; *Improving Deep Neural Networks: Hyperparameter Tuning, Regularization and Optimization*; *Structuring Machine Learning Projects*; *Convolutional Neural Networks*; *Sequence Models*. Labs were implemented using TensorFlow.

2022 **Stanford Algorithms Specialization**
Completed all four Coursera courses: *Divide and Conquer, Sorting and Searching, and Randomized Algorithms*; *Graph Search, Shortest Paths, and Data Structures*; *Greedy Algorithms, Minimum Spanning Trees, and Dynamic Programming*; *Shortest Paths Revisited, NP-Complete Problems and What To Do About Them*.

2021 **IBM Data Science Professional Certificate**
Completed all nine Coursera courses required for the IBM Data Science Professional Certificate, including *Machine Learning with Python*; *Databases and SQL for Data Science*; *Data Analysis with Python*; *Data Visualization with Python*; *Applied Data Science Capstone*. Performed k-means clustering on Singaporean neighborhoods to group similar neighborhoods for the Applied Data Science Capstone project.

Duke Course on Introduction to Machine Learning
Coursera Course on deep learning that introduces multi-layer perceptron, convolutional neural networks, natural language processing and reinforcement learning. All labs were implemented in PyTorch.

References

Available on Request