

# MENGXIN DU

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## EDUCATION

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**Doctor of Philosophy in Physics** Aug 2025

University of Texas at Dallas, Richardson, TX

Advisor: Chuanwei Zhang

**Master of Science in Physics** May 2019

Brown University, Providence, RI

Thesis: Evaluation of Scarlet for realistic weak lensing mass measurements

Advisor: Ian Dell' Antonio

**Bachelor of Science in Physics** May 2017

University of Science and Technology of China, Hefei, Anhui, China

Thesis: Verification of Randomness in Quantum Physics

Advisor: Yongsheng Zhang

## RESEARCH INTEREST

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Non equilibrium Quantum Many Body Physics

- Driven and Disordered Systems
- Dynamical Phase Transition and Transport in Many Body Systems
- Measurement Induced Phase Transitions (Quantum Information)

Quantum Information

- Quantum Error Correction Theory
- Geometry of Quantum Code Spaces
- Machine Learning based Code Searching

## EMPLOYMENT HISTORY

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**Research Assistant, University of Texas at Dallas**, Richardson, TX, Aug 2021 - Aug 2025

- Advisor: Prof. Chuanwei Zhang
- Initialized projects through constructive discussions
- Conducted collaborative researches in various fields
- Advised junior students and assisted swift adaptation to lab works

**Teaching Assistant, University of Texas at Dallas**, Richardson, TX, Aug 2019 - May 2020

- Lectured and organized a class of 100+ students
- Managed elementary lab equipment

## **RESEARCH EXPERIENCE**

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**Interacting dynamical Anderson Metal-Insulator transition in kicked Bose-Einstein condensates: The effect of trapping potentials.** Jun 2022 - Dec 2024  
Advisor: Chuanwei Zhang (Department of Physics, The University of Texas at Dallas, Richardson, Texas), Subhadeep Gupta (Department of Physics, University of Washington, Seattle, Washington)

- Investigated cold atom systems with aperiodic drive (experimental works lead by Prof. Gupta)
- Created synthetic Anderson Metal-Insulator transition with many body interactions
- Simulated realistic dynamics in experiments and predicted the phase diagram
- Analyzed phase transition and identified as a novel type of phase transition
- Collaborational work accepted. Theoretical preprint publication expected in December 2025

**Time Crystals with Time Independent Hamiltonians in Optical Cavity.** Dec 2023 - Present  
Advisor: Michael Kolodrubetz (Department of Physics, The University of Texas at Dallas, Richardson, Texas)

- Inspired by driven Majorana model with short edge modes, we found strong signals found in its Ising counterpart in optical cavity
- Realized totally time independent Hamiltonian with experimentally realistic observables by mapping Floquet Hamiltonian to extended zone picture in cavity QED
- Discovered a novel type of time crystal in equilibrium circumventing the no-go theorem
- Preprint publication expected in December 2025

**Characterizing Quantum Codes via the Coefficients in Knill-Laflamme Conditions.** Jun 2024 - Sep 2025  
Advisor: Bei Zeng (Department of Physics, The University of Texas at Dallas, Richardson, Texas)

- Developed novel mathematical framework using signature vectors to analyze quantum error-correcting codes through Knill-Laflamme coefficients
- Formulated optimization algorithm on Stiefel manifolds to systematically explore quantum code spaces
- Characterized cyclic symmetry preserving paths between known quantum codes, providing new insights into code relationships
- Identified new classes of quantum codes in ((7,2,3)) and ((6,2,3))
- Preprint published at arXiv:2410.07983, submitted to *npj Quantum* for peer review

**Coherent Matter Wave Emission from Atomtronic Transistors** Jun 2024 - Aug 2025  
Advisors: Michael Kolodrubetz and Chuanwei Zhang (Department of Physics, The University of Texas at Dallas, Richardson, TX)

- Investigated coherent atom transport in a triple-well Bose–Einstein condensate modeled by the time-dependent Gross-Pitaevskii equation
- Simulated transistor-like dynamics showing resonant tunneling between source, gate, and drain wells
- Identified coherence peaks corresponding to single-particle resonances rather than interaction-induced broadening

Demonstrated that matter-wave coherence is maximized in the weakly interacting regime, contrasting previous many-body predictions

## TECHNICAL SKILLS

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Programming:	C, Python, MATLAB, Julia, Mathematica
Software:	Linux, Microsoft Office, LaTeX, Pennylane, Pytorch, Qiskit, Matplotlib, Numqi, Parallel Computing (Launcher), GPU Computing (CuPy, Numba)
Technique/Platform:	Github, Cold Atomic System Simulation (GP), Open Quantum System Simulation (SSE, MCTDH, Linblad, TEBD), Quantum Network Simulation, Many Body System Simulation, Neural Network Training, General Machine Learning, Critical Exponent Estimation

## HONORS AND AWARDS

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**Margie Renfrow Student Support Fund, University of Texas at Dallas**  
Physics Scholarships Committee, University of Texas at Dallas

2024

## REFEREE LIST

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**Dr. Chuanwei Zhang**

Professor of Physics,  
Department of Physics, Washington University in St. Louis  
Email: [chuanwei.zhang@wustl.edu](mailto:chuanwei.zhang@wustl.edu)

**Dr. Michael Kolodrubetz**

Associate Professor of Physics,  
Department of Physics, University of Texas at Dallas  
Email: [mkolodru@utdallas.edu](mailto:mkolodru@utdallas.edu)

**Dr. Bei Zeng**

Professor of Physics,  
Department of Physics,  
University of Texas at Dallas  
Email: [bei.zeng@utdallas.edu](mailto:bei.zeng@utdallas.edu)

## FUNDINGS

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<b>National Science Foundation No. 2228725</b>	2020-2025
<b>Expanding Capacity in Quantum Information Science and Engineering (Expand QISE)</b>	2025-2026

## PUBLICATIONS

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### *Journal Publications Accepted*

Jun Hui See Toh, **Mengxin Du**, Xinxin Tang, Ying Su, Tristan Rojo, Carson O. Patterson, Nicolas R. Williams, Chuanwei Zhang, and Subhadeep Gupta. "Interaction Effects on the Dynamical Anderson Metal-Insulator Transition Using Kicked Quantum Gases." *Physical Review Letters* 133, no. 7 (2024): 076301.

### *Arxiv Publications (Submitted to npj Quantum Information)*

Sasanka Dowarah, **Mengxin Du**, Alan Zanders, Shengwang Du, Michael Kolodrubetz, and Chuanwei Zhang. "Coherent Matter Wave Emission from an Atomtronic Transistor," arXiv preprint arXiv:[2510.03398 \(2025\)](https://arxiv.org/abs/2510.03398)

**Mengxin Du**, Chao Zhang, Yiu-Tung Poon, and Bei Zeng. "Characterizing Quantum Codes via the Coefficients in Knill-Laflamme Conditions." arXiv preprint arXiv:2410.07983 (2024).

### *Publications in Draft(planned to be published by December)*

**Mengxin Du** and Chuanwei Zhang. "Effect of many-body interaction on synthetic Anderson Metal-Insulator transition in kicked quantum gases"

**Mengxin Du**, Sasanka Dowarah, Samuel Begg, Saeed Rahamanian, Mohsen Yarmohammadi and Michael Kolodrubetz. "Cavity Induced Time Crystals in Spin Chains" arXiv preprint arXiv:2410.07983 (2024).

### *Conference Papers (Abstract-Reviewed)*

**Mengxin Du** and Chuanwei Zhang, "Effect of many-body interaction on synthetic Anderson Metal-Insulator transition in kicked quantum gases," APS March Meeting 2023

**Mengxin Du** and Chuanwei Zhang, "Interacting dynamical Anderson Metal-Insulator transition in kicked Bose-Einstein condensates: the effect of trapping potentials," APS March Meeting 2024

## **SERVICE EXPERIENCE**

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### **Symposium Chair**

APS March Meeting, Las Vegas, NV, Session T66: Quantum Gases II, Mar 2023

### **CMD/QIS seminar Chair:**

University of Texas at Dallas, Department of Physics, Internal weekly meeting, 2021-2023

### **Volunteer Instructor**

Quantum Information Summer Camp, University of Texas at Dallas, Summer 2023

## **PROFESSIONAL MEMBERSHIPS**

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Graduate Student Member, American Physical Society,

Jun 2022 - Present

## **LANGUAGES**

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**English:** Advanced Speaker, **Chinese:** Native Speaker, **Japanese:** Native Speaker