

# Yuchen Guo Ph.D. Candidate

Department of Physics, Tsinghua University  
[guo-yc23@mails.tsinghua.edu.cn](mailto:guo-yc23@mails.tsinghua.edu.cn) | [Google Scholar](#) | [ResearchGate](#)



## Education

- B.Sc. in Physics: Tsinghua University | 2019 – 2023
- Ph.D. Candidate in Physics (Supervisor: Prof. Shuo Yang): Tsinghua University | 2023 – (expected 2028)
- Visiting student (Supervisor: Prof. J. Ignacio Cirac): Max Planck Institute of Quantum Optics (MPQ) | Mar–Aug 2026

## Awards

- Tsinghua University Special Scholarship (the highest honor for only 10 students in each year, 清华特奖), 2022
- Outstanding Graduate of Tsinghua University & Beijing (清华/北京优秀毕业生), 2023
- Outstanding Bachelor Thesis of Tsinghua University & Beijing (清华/北京优秀毕设), 2023
- National Scholarship for Ph.D. Students (博士生国奖), 2025
- NSFC Young Student Basic Research Project (博士生国自然科学基金), 2025

## Research Interests

Currently, I am focusing on solving problems in quantum computation, quantum information, and topological quantum matter with the tool of tensor network (TN) family.

- Developing new quantum computation techniques
- Discovering novel topological quantum matter
- Exploring the interplay between dissipation and entanglement in open systems

## Publications and preprints

I have published several research articles in top journals including *Phys. Rev. X*, *Phys. Rev. Lett.*, *PRX Quantum*, *npj Quantum Inform.*, etc.

### 1. Quantum computation & Quantum information

#### [1.1] [Quantum Error Mitigation via Matrix Product Operators](#)

**Yuchen Guo** and Shuo Yang  
*PRX Quantum* 3, 040313 (2022)

A new error mitigation approach based on the tensor network representation of the noise channels.

#### [1.2] [Noise effects on purity and quantum entanglement in terms of physical implementability](#)

**Yuchen Guo** and Shuo Yang  
*npj Quantum Inform.* 9, 11 (2023).

Two universal and concise inequations describing the destructive effects of quantum noise on purity and quantum entanglement.

- [1.3] [Triggering boundary phase transitions through bulk measurements in two-dimensional cluster states](#)

**Yuchen Guo**, Jian-Hao Zhang, Zhen Bi, and Shuo Yang

*Phys. Rev. Res.* 5, 043069 (2023)

Rich phase diagram on the 1D boundary of a 2D cluster state subject to bulk tunable measurements.

- [1.4] [Efficient Quantum Circuit Compilation for Near-Term Quantum Advantage](#)

**Yuchen Guo** and Shuo Yang

*EPJ Quantum Technol.* 12, 69 (2025)

An approximate quantum circuit compilation method that significantly reduces the circuit depth and increases the overall fidelity.

## 2. Locally purified density operators

- [2.1] [Quantum state tomography with locally purified density operators and local measurements](#)

**Yuchen Guo** and Shuo Yang

*Commun. Phys.* 7, 322 (2024).

A new quantum state tomography method based on tensor network representation that only involves local measurements.

- [2.2] [Locally purified density operators for noisy quantum circuits](#)

**Yuchen Guo** and Shuo Yang

*Chin. Phys. Lett.* 41, 120302 (2024, Editors' suggestion)

A universal scaling law between depth and error rate for tensor network representation of noisy quantum circuits.

- [2.3] [Locally Purified Density Operators for Symmetry-Protected Topological Phases in Mixed States](#)

**Yuchen Guo<sup>#</sup>**, Jian-Hao Zhang<sup>#</sup>, Hao-Ran Zhang, Shuo Yang, and Zhen Bi

*Phys. Rev. X* 15, 021060 (2025)

Construction and classification of symmetry protected topological phases in open systems with tensor network method.

## 3. Non-Hermitian physics & Open systems

- [3.1] [Construction of non-Hermitian parent Hamiltonian from matrix product states](#)

Ruohan Shen<sup>#</sup>, **Yuchen Guo<sup>#</sup>** and Shuo Yang

*Phys. Rev. Lett.* 130, 220401 (2023)

A new parent Hamiltonian method for systematically constructing non-Hermitian systems.

- [3.2] [Composite quantum phases in non-Hermitian systems](#)

**Yuchen Guo<sup>#</sup>**, Ruohan Shen<sup>#</sup>, and Shuo Yang

*Phys. Rev. Res.* 5, 033181 (2023)

A broad family of novel topological phases in non-Hermitian many-body systems without Hermitian counterpart not discovered before.

[3.3] [A New Framework for Quantum Phases in Open Systems: Steady State of Imaginary-Time Lindbladian Evolution](#)

**Yuchen Guo**, Ke Ding, and Shuo Yang  
arXiv:2408.03239

Defining and classifying open-system quantum phases using imaginary-time version of the Lindbladian equation.

[3.4] [Strong-to-weak spontaneous symmetry breaking meets average symmetry-protected topological order](#)

**Yuchen Guo** and Shuo Yang  
*Phys. Rev. B* 111, L201108 (2025, Editors' suggestion)

A new quantum phase intrinsic in open systems that exhibits both properties of spontaneous symmetry breaking and symmetry-protected topological order.

#### 4. Strongly-correlated electron systems

[4.1] [Unveiling Stripe-shaped Charge Modulations in Doped Mott Insulators](#)

Ning Xia, **Yuchen Guo** and Shuo Yang  
*Phys. Rev. Lett.* 135, 116504 (2025)

Reproduction of experimentally observed stripe- and ladder-shaped structures by simulation of doped Hubbard model with impurity potentials.

#### Talks and presentations

- Oral presentation, Asia Pacific Physics Conference), 2025.
- Oral presentation, APS Global Physics Summit, 2025.
- Invited talk, Fuzhou University Quantum Matter Seminars, 2024
- Invited talk, Youth Science Biweekly Forum, 2023

#### Reference

For more information about my study and research, please contact my supervisor and some of collaborators:

1. Prof. Shuo Yang, Tsinghua University, [shuoyang@tsinghua.edu.cn](mailto:shuoyang@tsinghua.edu.cn).
2. Prof. Zhen Bi, The Pennsylvania State University, [zjb5184@psu.edu](mailto:zjb5184@psu.edu).
3. Dr. Jian-Hao Zhang, University of Colorado Boulder, [sergio.zhang@colorado.edu](mailto:sergio.zhang@colorado.edu).