

# SHI FENG

Department of Physics, 191 W. Woodruff Ave, Columbus, Ohio 43210, USA

☎ (+1) 614 615 7144 • ✉ [feng.934@osu.edu](mailto:feng.934@osu.edu) • 📄 [fengshi96.github.io](https://github.com/fengshi96)

## Education

### The Ohio State University (OSU)

Columbus, Ohio, USA

Ph.D in Theoretical Physics

2018–Present

◦ Advisor: Nandini Trivedi

◦ Thesis: Fractionalization and entanglement in frustrated Mott insulators

### Xi'an Jiaotong University (XJTU)

Xi'an, Shaanxi, China

B.S. in Physics

2014–2018

◦ Honors Science Program (Physics), Qian Xuesen College

◦ Visiting Student in University of California, Riverside (UCR), 2016

## Interest & Expertise

- 1: Theoretical study of topological order, quantum spin liquids, and fractonic matter
- 3: Quantum magnetism and frustrated magnetism: phase transitions, spin dynamics, response theory
- 3: Quantum entanglement, non-equilibrium quantum dynamics, quantum circuit and error correction
- 4: Statistical models and machine learning methods relevant for condensed matter theory
- 5: Tensor network methods for quantum many-body systems: iMPS, DMRG, TEBD, etc

## Publications & Preprints

[10]: **S. Feng**, A. Agarwala, N. Trivedi, "Dimensional reduction of Kitaev spin liquid at quantum criticality", [arXiv:2308.08116](https://arxiv.org/abs/2308.08116) (2023)

[9]: K. Zhang, **S. Feng**, Y. D. Lensky, N. Trivedi, E. Kim, "Machine learning feature discovery of spinon Fermi surface", [arXiv:2306.03143](https://arxiv.org/abs/2306.03143) (2023)

[8]: **S. Feng**, D. Kong, N. Trivedi, "A statistical approach to topological entanglement: Boltzmann machine representation of higher-order irreducible correlation", [arXiv:2302.03212](https://arxiv.org/abs/2302.03212) (2023)

[7]: **S. Feng**, A. Agarwala, S. Bhattacharjee, N. Trivedi, "Anyon dynamics in field-driven phases of the anisotropic Kitaev model", *Phys. Rev. B* **108**, 035149 (2023)

[6]: **S. Feng**, Y. He, N. Trivedi, "Detection of long-range entanglement in gapped quantum spin liquids by local measurements", *Phys. Rev. A* **106**, 042417 (2022)

[5]: **S. Feng**, G. Alvarez, N. Trivedi, "Gapless to gapless phase transitions in quantum spin chains", *Phys. Rev. B* **105**, 014435 (2022)

[4]: **S. Feng**, N. D. Patel, P. Kim, J. H. Han, N. Trivedi, "Magnetic phase transitions in quantum spin-orbital liquids", *Phys. Rev. B*, **101**, 155112 (2020)

[3]: T. Xiao, J. Wang, S. Yang, Y. Zhu, D. Li, Z. Wang, **S. Feng**, L. Bu, X. Zhan, G. Lu, "Film-depth-dependent Crystallinity for Light Transmission and Charge Transport in Semitransparent Organic Solar Cells", *Journal of Materials Chemistry, A*, **2020**, 8, 401 (2020)

[2]: D. Li, S. Li, W. Lu, **S. Feng**, P. Wei, Y. Hu, X. Wang, G. Lu, "Rapidly measuring charge carrier mobility of organic semiconductor films upon a point-contact four-probes Method", *IEEE J-EDS* **2018.2872714** (2018)

[1]: L. Bu, S. Gao, W. Wang, L. Zhou, **S. Feng**, X. Chen, D. Yu, S. Li, G. Lu, "Film-depth-dependent light absorption and charge transport for polymer electronics", *Adv. Electron. Mater.*, **2**:1600359 (2016)

### In preparation:

[2]: **S. Feng**, "Kinetic constraint in perturbed  $Z_2$  topological matter"

[1]: **S. Feng**, X. Yang, N. Trivedi, "Non-linear pump-probe response of composite gauge fermions of  $Z_2$  topological order"

## Research Experiences

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### OSU

*Graduate Research Assistant*

**Columbus, OH, USA**

*2020–Present*

Advisor: Nandini Trivedi (Department of Physics, OSU)

- Quantum spin liquid: Kitaev model, response, entanglement and topological order.
- Statistical methods and machine learning approach to quantum many-body physics
- Magnetic phase transitions in one dimensional quantum spin (orbital) systems

### XJTU

*Undergraduate Research Assistant*

**Xi'an, Shaanxi, China**

*2017 - 2018*

Advisor: Guanghao Lu (Frontier Institute of Science and Technology, XJTU)

- Absorption and charge transport in semiconductor/insulator polymers
- In-situ reconstruction of tomography of nanowires buried in conjugated polymers

### UCLA

*Cross-disciplinary Scholars in Science and Technology*

**Los Angeles, CA, USA**

*Summer 2017*

Advisor: Hongwen Jiang (Department of Physics and Astronomy, UCLA)

- Electron beam induced defects in  $\text{SiO}_2$  using Monte Carlo simulation; Fabrication of MOS quantum dots by nano-imprint lithography that mitigates E-beam induced defects

### UCR

*Undergraduate Research Assistant*

**Riverside, CA, USA**

*Fall 2016*

Advisor: Marc Bockrath (Department of Physics, UCR)

- Nano fabrication and the analysis of electronic transport in twisted bilayer graphene

## Academic Activities

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**Jul, 2023: Boulder Summer School – Non-Equilibrium Quantum Dynamics**, Boulder, Colorado, USA

- Poster: Anyon response in field-induced quantum spin liquids

**May, 2023: TopoMag23 – Topology and Fractionalization in Magnetic Materials**, Columbus, Ohio, USA

- Poster: Anyon response in field-induced quantum spin liquids
- Lecture: Frustrated magnetism and quantum spin liquid

**Apr, 2023: Topology, Symmetry and Interactions in Crystals**, KITP-UCSB, California, USA

- Poster: Dynamics of Abelian anyons in the Kitaev model

**Mar, 2023: APS March Meeting**, American Physical Society

- Contributed Talk: Transition from Kitaev quantum spin liquid to weakly coupled critical spin chains

**Feb, 2023: Edward F. Hayes Advanced Research Forum**, OSU, Ohio, USA

- Contributed Talk: Anyon, fractionalization, and their detection

**Jun, 2022: Gordon Research Conference: Strongly Correlated Systems**, Mt. Holyoke College, MA, USA

- Poster: Discovery of novel topological phase in Kitaev spin liquid in a field

**Mar, 2022: APS March Meeting**, American Physical Society

- Contributed Talk: Spin response and magnetic absorption of Kitaev liquids under an external field.

**Mar, 2021: APS March Meeting**, American Physical Society

- Contributed Talk: Field-induced gapless-to-gapless phase transitions in integer spin chains.

**Aug, 2020: Ultra Quantum Matter**, Perimeter Institute for Theoretical Physics, Waterloo, Canada

**Jun, 2020: Condensed Matter Physics in all Cities**, University of Kent Canterbury, Kent, UK

- Contributed Talk: Magnetic phase transition in quantum spin orbital liquid.

## Honors and Awards

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**2023: Presidential Fellowship**, OSU, Columbus, OH, USA

- The Presidential Fellowship is the most prestigious award given by the Graduate School of OSU, embodying the highest standards of scholarship in the full range of Ohio State's graduate programs

**2023: 2nd place, Edward F. Hayes Advanced Research Forum, OSU, Columbus, OH, USA**

**2018: Siyuan Scholarship, XJTU, Xi'an, Shaanxi, China**

- Awarded to undergraduate students for their academic excellence

**2017: CSST Scholarship, UCLA, Los Angeles, CA, USA**

- Awarded in the UCLA-CSST program for cross-disciplinary scholars in science and technology

**2016: Meritorious Winner of Interdisciplinary Contest in Modelling, Bedford, MA, USA**

**2016: 1st Place Award of China Mathematical Contest in Modelling, Xi'an, Shaanxi, China**

**2013: 2nd Place Award of Chinese Physics Olympiad, Xi'an, Shaanxi, China**

## Teaching Experiences

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**Center for Emergent Material, OSU**

**Columbus, OH, USA**

*Lecturer, TopoMag23 Crash Course*

*May 2023*

- Crash course on frustrated magnetism and quantum spin liquid

**Department of Physics, OSU**

**Columbus, OH, USA**

*Graduate Teaching Assistant*

*2018-2021*

- Statistical Mechanics (Fall 2021, OSU)
- Introductory Physics – Electromagnetism, Optics, Modern Physics (Spring 2020, OSU)
- Introductory Physics – Mechanics, Thermal Physics, Waves (Fall 2019, OSU)
- Introductory Physics – Mechanics, Kinematics, Fluids, Waves (Spring 2019, OSU)
- Statistical Mechanics (Fall 2018, OSU)

## Technical Skills

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**Projects:** Developer and maintainer of

- [ExactDiagPy](#): Exact diagonalization for a generic many body Hamiltonian in Python
- [2DMonteCarlo](#): Real time visualization tool for Monte Carlo simulation using OpenGL in C++

**Programming Languages:** C++, Python, Julia, Perl, Matlab, Mathematica, Java, Bash

**Libraries and Softwares:**

- Libraries: Eigen, TenPy, DMRG++, ITensor, HDF5, OpenGL, Blas, Lapack
- Softwares: Blender, Inkscape

**OS and Clusters:**

- OS: Linux (Ubuntu), Windows, macOS, High Performance Computing (HPC) environments
- Clusters: Unity and Ohio Supercomputer Center (OSC)

## References

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Nandini Trivedi  
Professor, Physics,  
The Ohio State University  
[trivedi.15@osu.edu](mailto:trivedi.15@osu.edu)

Subhro Bhattacharjee  
Professor, Physics  
International Centre for Theoretical Sciences, Bengaluru, India  
[subhro@icts.res.in](mailto:subhro@icts.res.in)

Mohit Randeria  
Professor, Physics,  
The Ohio State University  
[randeria.1@osu.edu](mailto:randeria.1@osu.edu)

Eun-Ah Kim  
Professor, Physics,  
Cornell University  
[ek436@cornell.edu](mailto:ek436@cornell.edu)