

# SHI FENG

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## Education and Qualification

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### Technical University of Munich

Postdoctoral Fellow in Quantum Matter and Quantum Information Theory Group

◦ Advisors: M. Knap, J. Knolle and F. Pollmann

Garching, Germany

2024–Present

### The Ohio State University

Ph.D in Theoretical Condensed Matter Physics

◦ Advisor: N. Trivedi

◦ Dissertation: Fractionalization in Frustrated Quantum Matter

Columbus, Ohio, USA

2018–2024

### Xi'an Jiaotong University

B.S. in Physics (Honors Program), Qian Xuesen College

◦ Visiting student in UCR and UCLA, 2016–2017

Xi'an, Shaanxi, China

2014–2018

## Interest and Expertise

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1. Theoretical study of quantum spin liquids and topologically ordered matter
2. Non-equilibrium quantum dynamics, non-linear response and their application in condensed matter
3. Anderson localization, many-body localization, super-/sub-diffusion and anomalous transport
4. Quantum magnetism and frustrated systems: phase transitions, spin and energy transport
5. Tensor network methods for many-body systems: MPS, DMRG, time-evolution of tensor-network states
6. Statistical models and machine learning methods relevant for condensed matter theory

## Publications and Preprints

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1. *FFT-accelerated auxiliary variable MCMC for fermionic lattice models: a determinant-free approach with  $O(N \log N)$  complexity*  
D. Kong, **S. Feng**, J. Xie, Y. N. Wu  
[arXiv:2510.13866](https://arxiv.org/abs/2510.13866) (2025)
2. *Transient localization from fractionalization: vanishingly small conductivity in gapless quantum magnets*  
**S. Feng**, P. Zhu, J. Knolle, M. Knap  
[arXiv:2509.07062](https://arxiv.org/abs/2509.07062) (2025)
3. *Finite spinon density-of-states in triangular-lattice delafossite  $\text{TiYbSe}_2$*   
B. Belbase, A. Unnikrishnan, **S. Feng**, E. S. Choi, J. Knolle, A. Banerjee  
[arXiv:2504.05436](https://arxiv.org/abs/2504.05436) (2025)
4. *Obstruction to broken symmetries in topological flat bands*  
P. Zhu, **S. Feng**, Y.-M. Lu  
[Phys. Rev. B 111, L161411](https://arxiv.org/abs/2504.05436) (2025)
5. *Emergent quantum Majorana metal from a chiral spin liquid*  
P. Zhu<sup>†</sup>, **S. Feng**<sup>†</sup>, K. Wang<sup>†</sup>, T. Xiang, N. Trivedi (<sup>†</sup>Contributed Equally)  
[Nat. Commun. 16, 12345](https://arxiv.org/abs/2504.05436) (2025)
6. *Fractionalization signatures in the dynamics of quantum spin liquids*  
K. Wang<sup>†</sup>, **S. Feng**<sup>†</sup>, P. Zhu, R. Chi, H. Liao, N. Trivedi, T. Xiang (<sup>†</sup>Contributed Equally)  
[Phys. Rev. B 111, L100402](https://arxiv.org/abs/2504.05436) (2025), *Editor's Suggestion*
7. *Spin-orbit coupling controlled 2D magnetism in chromium trihalides*  
I. Lee, J. Chen, O. Molchanov, **S. Feng**, W. Huey, J. Tol, J. Goldberger, N. Trivedi, H.-Y. Kee, P. C. Hammel  
[arXiv:2405.16709](https://arxiv.org/abs/2405.16709) (2024)

8. *Dimensional reduction of Kitaev spin liquid at quantum criticality*  
**S. Feng**, A. Agarwala, N. Trivedi  
[Phys. Rev. Research 6, 013298 \(2024\)](#)
9. *Hidden subsystem symmetry protected states in competing topological orders*  
**S. Feng**  
[Phys. Rev. B 109, 075151 \(2024\)](#)
10. *Machine learning reveals features of spinon Fermi surface*  
 K. Zhang, **S. Feng**, Y. D. Lensky, N. Trivedi, E. A. Kim  
[Commun. Phys. 7, 54 \(2024\)](#)
11. *A statistical approach to topological entanglement: Boltzmann machine representation of high-order correlation*  
**S. Feng**, D. Kong, N. Trivedi  
[arXiv:2302.03212 \(2023\)](#)
12. *Anyon dynamics in field-driven phases of the anisotropic Kitaev model*  
**S. Feng**, A. Agarwala, S. Bhattacharjee, N. Trivedi  
[Phys. Rev. B 108, 035149 \(2023\)](#)
13. *Detection of long-range entanglement in gapped quantum spin liquids by local measurements*  
**S. Feng**, Y. He, N. Trivedi  
[Phys. Rev. A 106, 042417 \(2022\)](#)
14. *Gapless to gapless phase transitions in quantum spin chains*  
**S. Feng**, G. Alvarez, N. Trivedi  
[Phys. Rev. B 105, 014435 \(2022\)](#)
15. *Magnetic phase transitions in quantum spin-orbital liquids*  
**S. Feng**, N. D. Patel, P. Kim, J. H. Han, N. Trivedi  
[Phys. Rev. B 101, 155112 \(2020\)](#)
16. *Film-depth-dependent Crystallinity for Light Transmission and Charge Transport in Semitransparent Organic Solar Cells*  
 T. Xiao, J. Wang, S. Yang, Y. Zhu, D. Li, Z. Wang, **S. Feng**, L. Bu, X. Zhan, G. Lu  
[Journal of Materials Chemistry, A, 2020, 8, 401 \(2020\)](#)
17. *Rapidly measuring charge carrier mobility of organic semiconductor films upon a point-contact four-probes Method*  
 D. Li, S. Li, W. Lu, **S. Feng**, P. Wei, Y. Hu, X. Wang, G. Lu  
[IEEE J-EDS 2018.2872714 \(2018\)](#)
18. *Film-depth-dependent light absorption and charge transport for polymer electronics: A Case Study on Semiconductor/Insulator Blends by Plasma Etching*  
 L. Bu, S. Gao, W. Wang, L. Zhou, **S. Feng**, X. Chen, D. Yu, S. Li, G. Lu  
[Adv. Electron. Mater 2:1600359 \(2016\)](#)

## Research Experiences

### Technical University of Munich

Postdoctoral Fellow

Advisors: Michael Knap, Johannes Knolle and Frank Pollmann

- Topological physics in fractal and amorphous crystals
- Disorder-free localization and many-body localization
- Dynamical signatures of fractionalization
- Quantum spin liquid candidates in rare-earth delafossite
- Machine learning assisted QMC algorithms for condensed matter theory

### The Ohio State University

Graduate Research Assistant and Fellow

Garching, Germany

2024 - Present

Columbus, OH, USA

2018–2024

Advisor: Nandini Trivedi

- Theory of topological quantum matter: quantum spin liquid and Kitaev honeycomb model; detection of fractionalization; linear and non-linear response of fractionalized particles; spinon Fermi surface
- Quantum information: (topological) quantum entanglement, stabilizer code, cluster state, lattice gauge theory.
- Magnetism: quantum phase transitions and fractionalization in one dimensional frustrated systems
- Numerical methods: Exact diagonalization, matrix product states, density matrix renormalization group, time-evolving block decimation
- Statistical methods and machine learning approach to quantum many-body physics: Restricted Boltzmann machine, convolution neural network

**Xi'an Jiaotong University**

*Undergraduate Research Assistant*

Advisor: Prof. Guanghao Lu

- Transfer matrix method for light absorption in semiconductor
- In-situ reconstruction algorithm for semiconductor nano-tomography

**University of California, Los Angeles**

*Cross-disciplinary Scholars in Science and Technology*

Advisor: Prof. Hongwen Jiang

- Monte Carlo simulation of electron beam induced defects in SiO<sub>2</sub>
- Nano-imprint lithography of MOS quantum dots

**University of California, Riverside**

*Undergraduate Research Assistant*

Advisor: Prof. Marc Bockrath

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

**Xi'an, Shaanxi, China**

2017 - 2018

**Los Angeles, CA, USA**

2017

**Riverside, CA, USA**

2016

## Invited Presentations

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1. *Conference talk: Thermal paradox in quantum spin liquids*,  
44th International Conference on Strongly Correlated Systems -  
- Correlations and Coherence at Different Scales, Ustroń, Poland, 2025
2. *Seminar: From  $Z_2$  gauge theory to quantum Majorana metal*,  
Wrocław University of Science and Technology, Wrocław, Poland, 2025
3. *Seminar: Dynamical features of quantum spin liquids*,  
Institute of Physics, Chinese Academy of Sciences, Beijing, China, 2024
4. *Lecture: Frustrated magnetism and quantum spin liquid*,  
Topology and Fractionalization in Magnetic Materials, Columbus, Ohio, USA, 2023

## Other Conferences and Workshops

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**Sep. 2025: International Workshop on Constrained Quantum Matter**, Ettal, Germany

- Poster: Anderson localization in the dynamical response of quantum magnets

**Mar, 2025: DPG Spring Meeting**, German Physical Society

- Contributed Talk: Emergent quantum Majorana metal from a chiral spin liquid

**Jun, 2024: Gordon Research Conference: Correlated Electron Systems**, Mt. Holyoke College, MA, USA

- Poster: Majorana metal from a chiral spin liquid

**Mar, 2024: APS March Meeting**, American Physical Society

- Contributed Talk: Mobility constraint of anyons in a quantum spin liquid

**Oct, 2023: Q-PHORIA**, Pittsburgh Quantum Institute, Pittsburgh, PA, USA

- Poster: Dimensional reduction of quantum spin liquids

**Jul, 2023: Boulder Summer School – Non-Equilibrium Quantum Dynamics**, CU Boulder, CO, 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

**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: Correlated Electron 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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**2024: The Chinese Government Award for Outstanding Students Abroad**, Chinese Consulate in NY, USA

- The highest award granted by the Chinese government to Chinese students overseas

**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: Dirac Fellowship** (offer declined), University of Florida & National MagLab, Florida, USA

**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

## Academic Service

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### Peer Reviewer.....

- American Physical Society: Physical Review Letters; Physical Review Applied; Physical Review A; Physical Review B; Physical Review E
- IOP Publishing: Reports on Progress in Physics
- Springer Nature Group: Nature Communication
- Others: Quantum Information & Computation

### Teaching.....

**Department of Physics, Technical University of Munich**

*Lecturer*

**Garching, Germany**

*Summer, 2025*

- Advanced Methods in Quantum Many-Body Theory  
(Topics on Lattice Gauge Theory)

**Department of Physics, The Ohio State University**

*Graduate Teaching Assistant*

**Columbus, OH, USA**

*2018-2021*

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

## Mentored Students.....

**Department of Physics, The Ohio State University**

**Columbus, OH, USA**

*Undergraduate Students*

*2020-2022*

- Cullen Gantenberg (Dynamics of Abelian anyons in toric code, 2022) → PhD in University of Washington
- Seth Cox (Density matrix renormalization study of spin liquids, 2022) → PhD in Boston University

## Technical Skills

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**Code Library:** Developer and maintainer of

- [ExactDiagPy](#): Exact diagonalization with implementation of various quantum entanglement measures

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

**Libraries and Softwares:**

- Eigen, TenPy, DMRG++, ITensor, HDF5, OpenGL, Blas, Lapack; 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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