

SHI FENG

TUM Physics Department, James-Franck-Str. 1, 85748 Garching, Germany
✉ (+49) 152 5628 7360 • ✉ shi.feng@tum.de • ✉ fengshi96.github.io

Education and Qualification

Technical University of Munich

Postdoctoral Fellow in Quantum Matter and Quantum Information Theory Group

Garching, Germany

2024–Present

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

The Ohio State University

Ph.D in Theoretical Condensed Matter Physics

Columbus, Ohio, USA

2018–2024

- Advisor: N. Trivedi

○ **Dissertation:** Fractionalization in Frustrated Quantum Matter

Xi'an Jiaotong University

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

Xi'an, Shaanxi, China

2014–2018

- Visiting student in UCR and UCLA, 2016–2018

Interest and Expertise

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

1. *Triangular J_1 - J_2 Heisenberg antiferromagnet in a magnetic field*
T. Bader, **S. Feng**, S. Budaraju, B. Federico, J. Knolle, F. Pollmann
[arXiv:2512.08116](https://arxiv.org/abs/2512.08116) (2025)
2. *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)
3. *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)
4. *Finite spinon density-of-states in triangular-lattice delafoelite $TlYbSe_2$*
B. Belbase, A. Unnikrishnan, **S. Feng**, E. S. Choi, J. Knolle, A. Banerjee
[arXiv:2504.05436](https://arxiv.org/abs/2504.05436) (2025)
5. *Obstruction to broken symmetries in topological flat bands*
P. Zhu, **S. Feng**, Y.-M. Lu
Phys. Rev. B **111**, L161411 (2025)
6. *Emergent quantum Majorana metal from a chiral spin liquid*
P. Zhu[†], **S. Feng**[†], K. Wang[†], T. Xiang, N. Trivedi ([†]Contributed Equally)
Nat. Commun. **16**, 12345 (2025)
7. *Fractionalization signatures in the dynamics of quantum spin liquids*
K. Wang[†], **S. Feng**[†], P. Zhu, R. Chi, H. Liao, N. Trivedi, T. Xiang ([†]Contributed Equally)
Phys. Rev. B **111**, L100402 (2025), *Editor's Suggestion*

8. *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 \(2024\)](https://arxiv.org/abs/2405.16709)
9. *Dimensional reduction of Kitaev spin liquid at quantum criticality*
S. Feng, A. Agarwala, N. Trivedi
[Phys. Rev. Research 6, 013298 \(2024\)](https://doi.org/10.1103/PhysRevResearch.6.013298)
10. *Hidden subsystem symmetry protected states in competing topological orders*
S. Feng
[Phys. Rev. B 109, 075151 \(2024\)](https://doi.org/10.1103/PhysRevB.109.075151)
11. *Machine learning reveals features of spinon Fermi surface*
K. Zhang, **S. Feng**, Y. D. Lensky, N. Trivedi, E. A. Kim
[Commun. Phys. 7, 54 \(2024\)](https://doi.org/10.1103/CommunPhys.7.54)
12. *A statistical approach to topological entanglement: Boltzmann machine representation of high-order correlation*
S. Feng, D. Kong, N. Trivedi
[arXiv:2302.03212 \(2023\)](https://arxiv.org/abs/2302.03212)
13. *Anyon dynamics in field-driven phases of the anisotropic Kitaev model*
S. Feng, A. Agarwala, S. Bhattacharjee, N. Trivedi
[Phys. Rev. B 108, 035149 \(2023\)](https://doi.org/10.1103/PhysRevB.108.035149)
14. *Detection of long-range entanglement in gapped quantum spin liquids by local measurements*
S. Feng, Y. He, N. Trivedi
[Phys. Rev. A 106, 042417 \(2022\)](https://doi.org/10.1103/PhysRevA.106.042417)
15. *Gapless to gapless phase transitions in quantum spin chains*
S. Feng, G. Alvarez, N. Trivedi
[Phys. Rev. B 105, 014435 \(2022\)](https://doi.org/10.1103/PhysRevB.105.014435)
16. *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 \(2020\)](https://doi.org/10.1103/PhysRevB.101.155112)
17. *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 \(2020\)](https://doi.org/10.1039/DJ0A00081H)
18. *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 \(2018\)](https://doi.org/10.1109/JEDS48322.2018.2872714)
19. *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 \(2016\)](https://doi.org/10.1002/adv.21600359)

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

Garching, Germany

2024 - Present

The Ohio State University

Graduate Research Assistant and Fellow

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

University of California, Los Angeles

Los Angeles, CA, USA

Cross-disciplinary Scholars in Science and Technology

2017-2018

Advisor: Prof. Hongwen Jiang

- Monte Carlo simulation of electron beam induced defects in SiO₂
- Nano-imprint lithography of MOS quantum dots

University of California, Riverside

Riverside, CA, USA

Undergraduate Research Assistant

2016-2017

Advisor: Prof. Marc Bockrath

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

Xi'an Jiaotong University

Xi'an, Shaanxi, China

Undergraduate Research Assistant

2016

Advisor: Prof. Guanghao Lu

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

Invited Presentations

1. Seminar: *Localization from emergent gauge theory and thermal paradox in quantum spin liquids*, Nanjing, Jiangsu, China, 2025
2. Conference talk: *Thermal paradox in quantum spin liquids*, 44th International Conference on Strongly Correlated Systems - - Correlations and Coherence at Different Scales, Ustroń, Poland, 2025
3. Seminar: *From Z₂ gauge theory to quantum Majorana metal*, Wrocław University of Science and Technology, Wrocław, Poland, 2025
4. Seminar: *Dynamical features of quantum spin liquids*, Institute of Physics, Chinese Academy of Sciences, Beijing, China, 2024
5. Lecture: *Frustrated magnetism and quantum spin liquid*, Topology and Fractionalization in Magnetic Materials, Columbus, Ohio, USA, 2023

Other Conferences and Workshops

Dec. 2025: Advanced School and Conference on Quantum Matter, ICTP, Trieste, Italy

- Poster: Transient localization in a gapless spin liquid

Nov. 2025: Current Trends in Strongly Correlated and Frustrated Systems, Dresden, Germany

- Poster: Disorder-free localization of fractionalized particles

Oct. 2025: Munich Quantum Matter Days, Garching, Germany

- Poster: Transient localization by fractionalization

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

- 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

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, New Journal of 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

Undergraduate Students

Columbus, OH, USA

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
- Salim Karimov (Linear response in Kitaev spin liquid, 2023) → PhD in The Ohio State University

Technical Skills

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

Frank Pollmann
Professor, Physics,
TUM, Germany
frank.pollmann@tum.de

Michael Knap
Professor, Physics
TUM, Germany
michael.knap@tum.de

Johannes Knolle
Professor, Physics,
TUM, Germany
j.knolle@tum.de

Nandini Trivedi
Professor, Physics,
Ohio State, USA
trivedi.15@osu.edu

Tao Xiang
Professor, Physics,
IOP, CAS, China
txiang@iphy.ac.cn

Eun-Ah Kim
Professor, Physics,
Cornell University, USA
ek436@cornell.edu

Arnab Banerjee
Professor, Physics
Purdue University, USA
arnabb@purdue.edu

Subhro Bhattacharjee
Professor, Physics
ICTS, Tata Institute, India
subhro@icts.res.in

Ying Nian Wu
Professor, Statistics
UCLA, USA
ywu@stat.ucla.edu