SHI FENG

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Education

The Ohio State University (OSU) — **Columbus, Ohio, USA**
Ph.D in Condensed Matter Theory — *2018–Present*
- Advisor: Nandini Trivedi
- Thesis: Fractionalization and entanglement in frustrated systems

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 quantum spin liquids and topologically ordered matter
2. Quantum magnetism and frustrated magnetism: phase transitions, spin dynamics, response theory
3. Quantum entanglement, non-equilibrium quantum dynamics and their application in condensed matter
4. Tensor network methods for quantum many-body systems: MPS, DMRG, TEBD, etc
5. Statistical models and machine learning methods relevant for condensed matter theory

Publications & Preprints

1. *Dimensional reduction of Kitaev spin liquid at quantum criticality*
   S. Feng, A. Agarwala, N. Trivedi
   arXiv:2308.08116 (2023)
2. *Machine learning feature discovery of spinon Fermi surface*
   K. Zhang, **S. Feng**, Y. D. Lensky, N. Trivedi, E. A. Kim
   arXiv:2306.03143 (2023)
3. *A statistical approach to topological entanglement: Boltzmann machine representation of higher-order correlation*
   S. Feng, D. Kong, N. Trivedi
   arXiv:2302.03212 (2023)
4. *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)
5. *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)
6. *Gapless to gapless phase transitions in quantum spin chains*
   S. Feng, G. Alvarez, N. Trivedi
   Phys. Rev. B 105, 014435 (2022)
7. *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)
8. *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)
9. *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)

10. *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)

In preparation:

1. Kinetic constraint and emergent dipole conservation in perturbed Z_2 topological matter
S. Feng, N. Trivedi
2. Non-linear pump-probe response of composite gauge fermions of Z_2 topological order
S. Feng, X. Yang, N. Trivedi

Research Experiences

OSU **Columbus, OH, USA**
Graduate Research Assistant *2018–Present*
Advisor: Nandini Trivedi (Department of Physics, OSU)
- Theory of topological order: quantum spin liquid, Kitaev model, Toric code; detection of fractionalization and (long-range) entanglement; linear and non-linear response of fractionalized particles, emergent lattice gauge theory, anyon statistics, projected symmetry group.
- 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

XJTU **Xi'an, Shaanxi, China**
Undergraduate Research Assistant *2017 - 2018*
Advisor: Guanghao Lu (Frontier Institute of Science and Technology, XJTU)
- Absorption and charge transport in semiconductor/insulator polymers
- Algorithm for the in-situ reconstruction of nano-tomography in conjugated polymers

UCLA **Los Angeles, CA, USA**
Cross-disciplinary Scholars in Science and Technology *2017*
Advisor: Hongwen Jiang (Department of Physics and Astronomy, UCLA)
- Electron beam induced defects in SiO_2 using Monte Carlo simulation
- Nano-imprint lithography of MOS quantum dots

UCR **Riverside, CA, USA**
Undergraduate Research Assistant *2016*
Advisor: Marc Bockrath (Department of Physics, UCR)
- Nano fabrication and the analysis of electronic transport in twisted bilayer graphene

Academic Activities

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
- Invited 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

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

Teaching Experiences

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

Projects: Developer and maintainer of

- ExactDiagPy: Exact diagonalization for a generic many body Hamiltonian in Python, 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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Professor, Physics
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