

Sandeep Joy

CONTACT INFORMATION

National High Magnetic Field Laboratory
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EMPLOYMENT

National High Magnetic Field Laboratory & Florida State University, Tallahassee, FL, USA

September 2024 - present

Quantum Initiative Postdoctoral Fellow
Supervisor: Cyprian Lewandowski

EDUCATION

The Ohio State University, Columbus, OH, USA

August 2019 - September 2024

Ph.D. in Physics
Advisor: Brian Skinner

Indian Institute of Science Education and Research, Pune (IISER Pune), India

August 2014 - May 2019

Integrated BS-MS *with Distinction* (Major - Physics)

RESEARCH INTERESTS

Novel electronic phases, phase transitions, and transport signatures in quantum materials driven by Coulomb interaction, quantum geometry, and disorder.

PUBLICATIONS

1. [Sandeep Joy](#), Brian Skinner, [Watching electronic ice melt](#), Science 388 (2025) (**Perspective**) (commentary on Z. Xiang et al., Science 388 (2025).)
2. [Sandeep Joy](#), Brian Skinner, [Disorder-induced liquid-solid phase coexistence in 2D electron systems](#), arXiv:2502.11235
3. [Sandeep Joy](#), Brian Skinner, [Wigner crystallization in Bernal bilayer graphene](#), arXiv:2310.07751
4. [Sandeep Joy](#), Brian Skinner, [Upper bound on the window of density occupied by microemulsion phases in two-dimensional electron systems](#), Phys. Rev. B (Letter) 108 (2023)
5. Fangyuan Yang, Ruiheng Bai, Alexander A. Zibrov, [Sandeep Joy](#), Takashi Taniguchi, Kenji Watanabe, Brian Skinner, Mark O. Goerbig, Andrea F. Young, [Cascade of multi-electron bubble phases in monolayer graphene at high Landau level filling](#), Phys. Rev. Lett. 131 (2023) (*Editors' Suggestion*)
6. [Sandeep Joy](#), and Brian Skinner, [Wigner crystallization at large fine structure constant](#), Phys. Rev. B (Letter) 106 (2022)
7. [Sandeep Joy](#), Saad Khalid, and Brian Skinner, [Transparent mirror effect in twist-angle-disordered bilayer graphene](#), Phys. Rev. Research 2 (2020)

INVITED TALKS

The story of Wigner crystallization in Bernal bilayer graphene

- Condensed Matter Sciences Seminars, National High Magnetic Field Laboratory, 2024

Transparent mirror effect in twist-angle-disordered bilayer graphene

- Indian Institute of Science Education and Research, Pune, India, 2020

CONTRIBUTED TALKS

Disorder-induced liquid-solid phase coexistence in 2D electron systems

- APS March Meeting, American Physical Society, 2025

How prominent are microemulsion phases in 2D electron systems?

- APS March Meeting, American Physical Society, 2024

Wigner crystallization in Bernal bilayer graphene

- APS March Meeting, American Physical Society, 2023

Wigner crystallization at large fine structure constant

- APS March Meeting, American Physical Society, 2022

Transparent mirror effect in twist-angle-disordered bilayer graphene

- International Conference on Low Energy Electrodynamics in Solids (LEES), 2021
- Hayes Graduate Research Forum, The Ohio State University, 2021
- APS March Meeting, American Physical Society, 2021

POSTER
PRESENTATIONS

The nature of the quantum liquid-solid transition for 2D electrons

- FSU Quantum Initiative - Dirac Quantum Discussions Symposium, Florida, 2025
- Strong Correlation Across Newly Accessible Length and Energy Scales, Theory Winter School, National High Magnetic Field Laboratory, 2025

How prominent are microemulsion phases in 2D electron systems?

- Gordon Research Conference on Correlated Electron Systems: Unconventional Phenomena in Quantum Matter, Massachusetts, 2024

Wigner crystallization in Bernal bilayer graphene

- Q-PHORIA: Quantum Pennsylvania Ohio Regional Annual Conference, University of Pittsburgh, 2023
- Novel Quantum States of Matter in Moiré Materials, Aspen Center for Physics - Winter Conference, 2023
- Correlations in Flat Bands: From the FQHE to Moiré, Theory Winter School, National High Magnetic Field Laboratory, 2023
- Strongly Correlated Matter: from Quantum Criticality to Flat Bands, International Center for Theoretical Physics, Italy, 2022
- Gordon Research Conference on Correlated Electron Systems: Topology and Correlations: Long-Range Entanglement in Many-Body Systems, Massachusetts, 2022

SELECTED
AWARDS AND
FELLOWSHIPS

- Quantum Initiative Travel Award to attend the Boulder School 2025: Dynamics of Strongly Correlated Electrons, Florida State University, 2025
- Quantum Initiative Postdoctoral Fellowship, Florida State University/National High Magnetic Field Laboratory, 2024 - present
- Edward J. Ray Travel Award for Scholarship and Service, The Ohio State University, 2021
- German Academic Exchange - Working Internship in Science and Engineering (DAAD-WISE) Fellowship, 2017
- Indian Academy of Sciences Summer Research Fellowship, 2016
- KVPY Fellowship, Department of Science and Technology, Government of India, August 2015 - July 2019
- INSPIRE Fellowship, Department of Science and Technology, Government of India, August 2014 - July 2019

TEACHING EXPERIENCE

Graduate Teaching Assistant, The Ohio State University

- Physics 5501H - Honors Quantum Mechanics 2 and Physics 5401H Honors Advanced Electricity and Magnetism 2, Spring 2021
- Physics 5500H - Honors Quantum Mechanics 1, Fall 2020
- Physics 5400 - Intermediate Electricity and Magnetism, Spring 2020
- Physics 1250 - Mechanics, Work and Energy, Thermal Physics, Fall 2019

OUTREACH ACTIVITIES

- Graphene journal club organizer, Condensed Matter Science (Theory) Division, National High Magnetic Field Laboratory, 2025 - present
- Judge at Capital Regional Science and Engineering Fair, Tallahassee, Florida for middle school students, 2025
- Volunteer, MagLab (National High Magnetic Field Laboratory) representative at local school STEM events, 2024–present
- Trained tour guide at the MagLab (National High Magnetic Field Laboratory), 2024 - present
- Founding member and treasurer of graduate student organization “Random Interactions,” 2022-2024 Aims to foster engagement and collaboration among undergraduate students, graduate students, postdocs, and faculty working in condensed matter physics.
- Judge at State Science Day for high school and middle school students at Ohio Science Academy, 2021-2024.
- OSU Polaris Mentorship Programme 2021-2022
Mentored an underrepresented minority undergraduate student on a research project for two semesters.
- Elected Graduate Studies Committee student representative, Physics Department, 2021 - 2022
- Elected Climate and Diversity Committee student representative, Physics Department, 2020 - 2021

UNDERGRADUATE RESEARCH EXPERIENCE

- **Masters thesis: Understanding the quantum Hall edge states**
Supervisor: Dr Sreejith G J, IISER Pune, May 2018 - April 2019
- **Semester projects on theoretical condensed matter physics**
Supervisor: Dr Sreejith G J, IISER Pune, August - November 2017, January - April 2018
- **Summer project on effect of density induced tunneling on Bose–Hubbard model**
Supervisor: Dr Andreas Buchleitner, Albert-Ludwigs University of Freiburg, May - July 2017
- **Summer project on electronic structure calculation of IrO_2**
Supervisor: Dr Kalobaran Maiti, Tata Institute of Fundamental Research Mumbai, May - July, 2016

SELECTED PROFESSIONAL SERVICE

- Referee Services: Reviewer for Science, Newton (Cell Press) and Phase Transitions
- Reviewer for French National Research Agency (ANR) grant proposal

COMPUTATIONAL SKILLS

Python, Mathematica and L^AT_EX

REFERENCES

1. Brian Skinner

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2. Cyprian Lewandowski

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