Suman Mondal

Max Planck Institute for the Physics of Complex Systems
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Curriculum Vitae

Postdoctoral researcher, MPIPKS, Dresden, Germany

Personal Information

Date of Birth: **19th February, 1993**

Nationality : **Indian**

Sex : **Male**

Email : ***mondal@pks.mpg.de***

Alt. email : ***sumanf40@gmail.com***

Reseaech experiance

Guest Scientist
- **Institute :** Max Planck Institute for the Physics of Complex Systems, Germany
- **Year :** 2024 - Present

Postdoc
- **Institute :** University of Goettingen, Goettingen, Germany
- **Year :** 2021 - 2024
- **Supervisor:** Prof. Dr. Fabian Heidrich Meisner

Research Associate
- **Institute :** Indian Institute of Technology, Guwahati, India.
- **Year :** 2021 (5 months)
- **Supervisors:** Prof. Dr. Tapan Mishra and Prof. Dr. Kanhaiya Pandey

Education

Ph.D. (Physics)
- **Institute :** Indian Institute of Technology, Guwahati, India.
- **Year :** 2016 - 2021
- **Supervisor:** Prof. Dr. Tapan Mishra
- **Thesis title :** Equilibrium, Non-equilibrium and Topological Phases of Strongly Correlated Bosons

M.Sc. (Physics)
- **University :** University of Kalyani, West Bengal, India.
- **Year :** 2013-2015
- **Result division :** First Class.

B.Sc. (Physics)
- **University :** University of Kalyani, West Bengal, India.
- **Year :** 2010-2013
- **Result division :** First Class.

Achievements & Awards

2021 **Best thesis of the year award by Indian Institute of Technology Guwahati**.

2018 **Earned the Senior Research Fellowship by Indian Institute of Technology Guwahati**.

2016 **Qualified**, *CSIR-NET (National Eligibility Test)*.

2016 **Qualified**, *IIT-GATE (Graduate Aptitude Test in Engineering held by Indian Institute of Technology)*.

Research Interest

- Quantum phases and phase transitions in strongly correlated systems.
- Topological phase transitions and effect of interactions.
- Topological Thouless charge pumping.
- Non-equilibrium dynamics of quantum many-body systems.
- Many-body localization.
- Kinetically constrained systems.
- Electron-phonon coupled systems.

Numerical Skills

Computing Languages: **Python and Julia**.

Numerical Methods Known

- Density Matrix Renormalization Group (DMRG)
- Matrix Product States (MPS)
- Time Evolving Block Decimation (TEBD)
- Multi-trajectory Ehrenfest (MTE) method
- MTE + TEBD
- Quantum typicality
- Exact Diagonalization (ED)
- Cluster Mean-field theory (CMFT)

Numerical Codes Developed

- I have developed the DMRG, CMFT, and ED scripts which are used in my works. I also have my own TEBD code.
- For one of our ongoing projects, I have combined a semi-classical approach with the TEBD method to handle an electron-phonon coupled system.

List of Publications (under review)

1. Heiko Georg Menzler*, **Suman Mondal***, Fabian Heidrich-Meisner *Hybrid quantum-classical matrix-product state and Lanczos methods for electron-phonon systems with strong electronic correlations: Application to disordered systems coupled to Einstein phonons*, arXiv:2512.10899 (2025).
2. Biswajit Paul, **Suman Mondal**, Tapan Mishra *Anomalous slow-down of the bound state dynamics in a non-locally coupled quantum circuit*, arXiv:2506.09818 (2025).

List of Publications (published)

1. **Suman Mondal** and Fabian Heidrich-Meisner, *Delocalization in a partially disordered interacting many-body system*, Phys. Rev. B **109** 125127 (2024).
2. Karl Royen, **Suman Mondal**, Frank Pollmann, Fabian Heidrich-Meisner, *Enhanced many-body*

localization in a kinetically constrained model, Phys. Rev. E **109** 024136 (2024).

3. Ashirbad Padhan, **Suman Mondal**, Smitha Vishveshwara, and Tapan Mishra, *Interacting bosons on a Su-Schrieffer-Heeger ladder: Topological phases and Thouless pumping*, Phys. Rev. B **109**, 085120 (2024).

4. **Suman Mondal**, Adhip Agarwala, Tapan Mishra, and Abhishodh Prakash, *Symmetry-Enriched Criticality in a Coupled Spin-Ladder*, **Editors' Suggestion**, Phys. Rev. B **108**, 245135 (2023).

5. **Suman Mondal**, Eric Bertok, and Fabian Heidrich-Meisner, *Phonon-induced breakdown of Thouless pumping in the Rice-Mele-Holstein model*, Phys. Rev. B **106**, 235118 (2022).

6. Mrinal Kanti Giri, **Suman Mondal**, Bhanu Pratap Das, and Tapan Mishra, *Non-trivial pairing in the quantum walk of two-component Bose-Hubbard model*, Phys. Rev. Lett. **129**, 050601 (2022).

7. **Suman Mondal**, Ashirbad Padhan, Tapan Mishra, *Realizing symmetry protected topological phase through dimerized interaction*, Phys. Rev. B Lett. **106**, L201106 (2022).

8. Ashirbad Padhan, Mrinal Kanti Giri, **Suman Mondal**, and Tapan Mishra, *Emergence of multiple localization transitions in a one-dimensional quasiperiodic lattice*, Phys. Rev. B Lett. **105**, L220201 (2022).

9. Aoi Hayashi, **Suman Mondal**, Tapan Mishra, and Bhanu Pratap Das, *Competing insulating phases in a dimerized extended Bose-Hubbard model*, Phys. Rev. A **106**, 013313 (2022).

10. **Suman Mondal**, Sebastian Greschner, Luis Santos, and Tapan Mishra, *Topological inheritance in two-component Hubbard models with single-component Su-Schrieffer-Heeger dimerization*, Phys. Rev. A **104**, 013315 (2021).

11. Mrinal Kanti Giri, **Suman Mondal**, and Tapan Mishra, *Two component quantum walk in one-dimensional lattice with hopping imbalance*, Scientific Reports **11**, 22056 (2021).

12. Sayan Lahiri, **Suman Mondal**, Kanhaiya Pandey and Tapan Mishra, *Correlated photon pair propagation in circuit QED with superconducting processors*, Phys. Rev. A **102**, 043710(2020).

13. Sayan Lahiri, **Suman Mondal**, Manpreet Singh and Tapan Mishra, *Mott insulator phases of nonlocally coupled bosons in bilayer optical superlattices*, Phys. Rev. A **101**, 063624(2020).

14. **Suman Mondal**, Augustine Kshetrimayum and Tapan Mishra, *Two-body repulsive bound pairs in a multibody interacting Bose-Hubbard model*, Phys. Rev. A **102**, 023312(2020).

15. **Suman Mondal** and Tapan Mishra, *Quantum walks of interacting Mott insulator defects with three-body interactions*, Phys. Rev. A **101**, 052341(2020).

16. Sebastian Greschner, **Suman Mondal** and Tapan Mishra, *Topological charge pumping of bound bosonic pairs*, Phys. Rev. A **101**, 053630(2020).

17. **Suman Mondal**, Sebastian Greschner and Tapan Mishra, *Three-body constrained bosons in double-well optical lattice*, Phys. Rev. A **100**, 013627(2019).

18. Manpreet Singh, **Suman Mondal**, B. K. Sahoo and Tapan Mishra, *Quantum phases of constrained dipolar bosons in coupled one-dimensional optical lattices*, Phys. Rev. A **96**, 053604(2017).

Teaching

- Tutor in the course *Analytical mechanics.*
- Tutor in the course *Important models in Condensed Matter Physics.*
- Tutor in the course *Advanced Computational Physics Lab* for three semesters.

Research group visits

- Prof. Lev Vidmar's group for three days, Jozef Stefan Institute.
- Prof. Ulrich Schneider's group for a week, University of Cambridge.
- Prof. Robin Steinigeweg's group for a week, University of Osnabrueck.

Schools /Conferences/ Workshops/ Meetings (from 2022)

- *FOR 5522 PhD School on Nonergodic Quantum Dynamics*, 2024, University of Goettingen, Goettingen, Germany.
- *55th Annual Meeting of the APS Division of Atomic, Molecular and Optical Physics*, 2024, Fort Worth, Texas, USA.
- *FOR 5522 collaboration meeting on transport*, 2024, Max Planck Institute of Quantum Optics, Germany.
- *DPG Annual Meeting of the Condensed Matter Section (SKM)*, 2024, Berlin, Germany.
- *FOR 5522 collaboration meeting on Kinetically Constrained Models*, January 2024, University of Tübingen, Germany.

- *International Workshop on Correlated Dynamics in Energy Conversion*, September 2023, University of Goettingen, Goettingen, Germany.
- *International Workshop on Correlated Dynamics in Energy Conversion*, September 2023, University of Goettingen, Goettingen, Germany.
- *School on Quantum Many-Body Phenomena out of Equilibrium: from Chaos to Criticality*, Aug 2023, The Abdus Salam International Centre for Theoretical Physics (ICTP), Trieste, Italy.
- *Lower Saxony Meeting 2023*, July 2023, Osnabruck University, Osnabruck, Germany.
- *Annual Workshop FOR 2414 Hamburg*, March 2023, Centre for Optical Quantum Technologies, Hamburg, Germany.
- *DPG Spring Meeting of the Condensed Matter Section (SKM)*, 2023, Dresden, Germany.
- *Quantum Dynamics: From Electrons to Qbits*, Aug 2022, The Abdus Salam International Centre for Theoretical Physics (ICTP), Trieste, Italy.
- *Topological Phases in Condensed Matters and Cold Atom Systems*, June 2022, Institut d'Etude Scientifique de Cargese (IESC), Cargese, France.
- *Finite Temperature Non-equilibrium Superfluid Systems*, May 2022 St. Martin, Germany.

Talks (recent, from 2022)

- Title: *Thouless charge pumping at finite temperature.*
  APS Division of Atomic, Molecular and Optical Physics, 2024, Fort Worth, Texas, USA.
- Title: *Delocalization in a partially disordered interacting many-body system.*
  DPG Annual Meeting of the Condensed Matter Section (SKM), 2024, Berlin, Germany.
- Title: *Disorder and interacting many-body systems.*
  Jozef Stefan Institute, 2024, Ljubljana.
- Title: *Delocalization in a partially disordered interacting many-body system.*
  FOR 5522 collaboration meeting on transport, 2024, Max Planck Institute of Quantum Optics, Germany.
- Title: *Enhanced many-body localization in a kinetically constrained model.*
  FOR 5522 collaboration meeting on Kinetically Constrained Models, 2024, University of Tübingen, Germany.
- Title: *Thouless charge pumping at finite temperature.*

In the Lower Saxony Meeting 2023, Osnabruck University, Germany.

- Title: *Phonon-induced breakdown of Thouless pumping in the Rice-Mele-Holstein model.*
  In the DPG Spring Meeting of the Condensed Matter Section (SKM), 2023, Dresden, Germany.

- Title: *Emergence of multiple localization transitions in a one-dimensional quasiperiodic lattice.*
  In the Condensed Matter Physics seminar series, 2022, ITP, University of Goettingen, Germany.

- Title: *Phonon-induced breakdown of Thouless pumping in the Rice-Mele-Holstein model.*
  In the Condensed Matter Physics seminar series, 2022, ITP, University of Goettingen, Germany.

- Several journal club talks. Topics: Quantum supremacy (Google experiment), Hilbert space fragmentation, Fractional quantum Hall effect (Experimental observation in cold atom systems).

Posters (recent, from 2022)

- Title: *Phonon-induced breakdown of Thouless pumping in the Rice-Mele-Holstein model.*
  In the conference *Finite Temperature Non-equilibrium Superfluid Systems*, 2022, St. Martin, Germany.

- Title: *Phonon-induced breakdown of Thouless pumping in the Rice-Mele-Holstein model.*
  In the summer school *Topological Phases in Condensed Matters and Cold Atom Systems*, 2022, Cargese, France.

- Title: *Phonon-induced breakdown of Thouless pumping in the Rice-Mele-Holstein model.*
  In the *Annual Workshop FOR 2414*, 2023, Hamburg, Germany.

- Title: *Phonon-induced breakdown of Thouless pumping in the Rice-Mele-Holstein model.*
  In the *Annual Workshop FOR 2414*, 2023, Hamburg, Germany.

- Title: *Phonon-induced breakdown of Thouless pumping in the Rice-Mele-Holstein model.*
  In the *School on Quantum Many-Body Phenomena out of Equilibrium: from Chaos to Criticality*, 2023, ICTP, Trieste, Italy.

- Title: *Localization property of a partially disordered interacting many-body system.*
  In the *International Workshop on Correlated Dynamics in Energy Conversion*, 2023, University of Goettingen, Germany.

- Title: *Localization property of a partially disordered interacting many-body system.*
  In the workshop *Current Topics in the Nonequilibrium Physics of Quantum Many-Body Systems*, 2023, University of Goettingen, Germany.

- Title: *Delocalization in a partially disordered interacting many-body system.*
  In *DPG Annual Meeting of the Condensed Matter Section (SKM)*, 2024, TU Berlin, Germany.

- Title: *Delocalization in a partially disordered interacting many-body system.*
  In *APS, Division of Atomic, Molecular and Optical Physics*, 2024, Fort Worth, Texas, USA.

- Title: *Delocalization in a partially disordered interacting many-body system.*
  In *FOR 5522 PhD School on Nonergodic Quantum Dynamics*, 2024, University of Goettingen, Goettingen, Germany.

Projects

2014-2015 **M.Sc Project**, *University of Kalyani*, West Bengal, India.

Title: **Characteristics of the density-dependent hopping of d-electrons within Falicov-Kimball model**.