Abhirup Mukherjee

Doctoral Researcher

Department of Physical Sciences, Indian Institute of Science Education and Research Kolkata, India

West Bengal, India | am18ip014@iiserkol.ac.in | arXiv | Scholar | Website | (+91) 7595-914-112

Research Experience

Indian Institute of Science Education and Research Kolkata, India | Prof. Siddhartha Lal — Doctoral Research
Study of Mott transitions and non-Fermi liquids through Kondo breakdown — *2021 - ongoing*

Indian Institute of Science Education and Research Kolkata, India | Prof. Siddhartha Lal — M.Sc. Thesis
Unitary renormalisation group study of an extended Anderson impurity model — *2020 - 2021*

Ramakrishna Mission Vidyamandira, India | Prof. Pushpajit Halder — B.Sc. Final Year Project
The EPR paradox: Entangled states — *2018*

Publications and Preprints

Mott Criticality as the Confinement Transition of a Pseudogap-Mott Metal — July 2025
Abhirup Mukherjee, S. R. Hassan, Anamitra Mukherjee, N. S. Vidhyadhiraja, A. Taraphder, Siddhartha Lal — **arXiv:2507.17201**

Revealing the magnetic dimensional crossover in the Heisenberg ferromagnet $CrSiTe_3$ through picosecond strain pulses — April 2025
Anjan Kumar N M, Soumya Mukherjee, *Abhirup Mukherjee*, Ajinkya Punjal, Shubham Purwar, Thirupathaiah Setti, Shriganesh Prabhu S., Siddhartha Lal, N. Kamaraju — **Phys. Rev. B 111, L140414**

Holographic entanglement renormalisation for fermionic quantum matter — June 2024
Abhirup Mukherjee, Siddhartha Patra, Siddhartha Lal — **J. Phys. A: Math. Theor. 57 275401**

Kondo frustration via charge fluctuations: a route to Mott localisation — November 2023
Abhirup Mukherjee, N S Vidhyadhiraja, A Taraphder, Siddhartha Lal — **New J. Phys. 25 113011**

Frustration shapes multi-channel Kondo physics: a star graph perspective — May 2023
Siddhartha Patra, *Abhirup Mukherjee*, Anirban Mukherjee, N S Vidhyadhiraja, A Taraphder, Siddhartha Lal — **J. Phys.: Condens. Matter 35 315601**

Unveiling the Kondo cloud: Unitary renormalization-group study of the Kondo model — February 2022
Anirban Mukherjee, *Abhirup Mukherjee*, N. S. Vidhyadhiraja, A. Taraphder, Siddhartha Lal — **Phys. Rev. B 105, 085119**

Ongoing Projects

Punctured-Chern invariant at IQHE plateau-to-plateau transitions: A unitary RG study
Abhirup Mukherjee, Sumiran Pujari, Siddhartha Lal

Some universal features of Kondo breakdown: Insights into Mott criticality
Debraj Debata, *Abhirup Mukherjee*, Siddhartha Lal

Kondo breakdown as a measurement-driven entanglement transition
Debraj Debata, *Abhirup Mukherjee*, Siddhartha Lal

Quantum criticality in a three-orbital impurity model
Debraj Debata*, Aashish Kumar*, *Abhirup Mukherjee*, Siddhartha Lal

Education

Indian Institute of Science Education and Research (*IISER*) Kolkata, India — **M.Sc. + Ph.D. in Physics**
CGPA: 9.61 — *2018 - ongoing*

Ramakrishna Mission Vidyamandira (Autonomous), University of Calcutta, India — **B.Sc. in Physics (Hons.)**
CGPA: 9.22 — *2015 - 2018*

Technical Skills

- Field theory-based techniques (unitary renormalisation group method) and *low-energy Hamiltonian* methods
- Computation of two-point and multi-point *correlation functions and entanglement measures* in fermionic systems
- *Julia* and Python for numerical computation

Talks and Poster Presentations

- Poster: 7th Annual Conference on Quantum Condensed Matter — December 2024, IIT Guwahati
- Poster: Young Investigators Meet on Quantum Condensed Matter Theory — December 2023, IISER Bhopal
- Poster: Conference on Emergent phenomena in Quantum MATerials — October 2022, IIT Roorkee
- Talk on *Insights On The Pseudogap In 2D From An Impurity Model* at DPS Day, Department of Physical Sciences — June 2025, IISER Kolkata
- Talk on *Kondo Effect and Its Breakdown: Interplay of Fluctuations in Zero Dimensions* at PP65: Physics Trends at IISER Kolkata — June 2023, IISER Kolkata

Teaching Experience

Teaching Assistantship at IISER Kolkata

- Condensed Matter Physics II (2022). Instructor: Prof. Siddhartha Lal
- Quantum Mechanics. (2023) Instructor: Prof. Siddhartha Lal
- Computational Physics (2024). Instructor: Prof. Rangeet Bhattacharyya

Awards and Honours

- Qualified *CSIR-UGC NET* with All India Rank (AIR) 59 (Dec 2018)
- Gold medallist, National Graduate Physics Examination (*NGPE*) - 2018
- Qualified *JAM* (AIR 10) and *JEST* (AIR 21) — national-level entrance exams for M.Sc/Ph.D. in India
- Silver medallist, *B.Sc. (Hons.)*, Ramakrishna Mission Vidyamandira, University of Calcutta, (2015-2018)

References

Prof. Siddhartha Lal (*Ph.D. advisor*)
Department of Physical Sciences
IISER Kolkata, India
slal@iiserkol.ac.in

Dr. Kamaraju Natarajan
Department of Physical Sciences
IISER Kolkata, India
nkamaraju@iiserkol.ac.in

Prof. Syed R Hassan
The Institute of Mathematical Sciences, India
shassan@imsc.res.in

Dr. Anamitra Mukherjee
School of Physical Sciences
National Institute of Science, Education and Research, India
anamitra@niser.ac.in

Prof. Vidhyadhiraja N S
Theoretical Sciences Unit
Jawaharlal Nehru Center for Advanced Scientific Research, India
raja@jncasr.ac.in

Prof. A Taraphder
Department of Physics
Indian Institute of Technology Kharagpur, India
arghya@phy.iitkgp.ac.in