

# Abhirup Mukherjee | Doctoral Researcher

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## 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, A Mukherjee, N S. Vidhyadhiraja, A Taraphder, S Lal    **arXiv:2507.17201**
- Revealing the magnetic dimensional crossover in the Heisenberg ferromagnet  $\text{CrSiTe}_3$  through picosecond strain pulses    April 2025  
A Kumar N M, S Mukherjee, **Abhirup Mukherjee**, A Punjal, S Purwar, T Setti, S Prabhu S., S Lal, N Kamaraju    **Phys. Rev. B 111, L140414**
- Holographic entanglement renormalisation for fermionic quantum matter    June 2024  
**Abhirup Mukherjee**, S Patra, S 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, S Lal    **New J. Phys. 25 113011**
- Frustration shapes multi-channel Kondo physics: a star graph perspective    May 2023  
S Patra, **Abhirup Mukherjee**, A Mukherjee, N S Vidhyadhiraja, A Taraphder, S Lal    **J. Phys.: Condens. Matter 35 315601**
- Unveiling the Kondo cloud: Unitary renormalization-group study of the Kondo model    February 2022  
A Mukherjee, **Abhirup Mukherjee**, N S. Vidhyadhiraja, A Taraphder, S Lal    **Phys. Rev. B 105, 085119**

## ONGOING PROJECTS

- Punctured-Chern invariant at IQHE plateau-to-plateau transitions: A unitary RG study  
**Abhirup Mukherjee**, S Pujari, S Lal
- Some universal features of Kondo breakdown: Insights into Mott criticality  
D Debata, **Abhirup Mukherjee**, S Lal
- Kondo breakdown as a measurement-driven entanglement transition  
D Debata, **Abhirup Mukherjee**, S Lal
- Quantum criticality in a three-orbital impurity model  
D Debata\*, A Kumar\*, **Abhirup Mukherjee**, S Lal

## EDUCATION

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Indian Institute of Science Education and Research (IISER) Kolkata, India  
CGPA: 9.61

**M.Sc. + Ph.D. in Physics**  
2018 - ongoing

Ramakrishna Mission Vidyamandira (Autonomous), University of Calcutta, India  
CGPA: 9.22

**B.Sc. in Physics (Hons.)**  
2015 - 2018

## TECHNICAL SKILLS

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- 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
- Numerical computation of dynamical correlations (spectral function, self-energy, etc) using exact diagonalisation
- Julia and python for numerical computation

## TALKS AND POSTER PRESENTATIONS

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- 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

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### 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

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- 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

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**Prof. Siddhartha Lal** (*Ph.D. advisor*)  
Department of Physical Sciences, IISER Kolkata, India  
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Theoretical Sciences Unit, Jawaharlal Nehru Center for  
Advanced Scientific Research, India  
[raja@jncasr.ac.in](mailto:raja@jncasr.ac.in)

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