

# 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, Anamitra Mukherjee, N. S. Vidhyadhiraja, A. Taraphder, Siddhartha Lal*      **arXiv:2507.17201**
- Revealing the magnetic dimensional crossover in the Heisenberg ferromagnet CrSiTe<sub>3</sub> 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: geometrical and topological aspects**      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

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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
- *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

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