

# Ritajit Kundu

Institute of Mathematical Sciences, CIT Campus, Chennai 600113, India

✉ ritajitk@gmail.com •  0000-0003-4917-4020

## Education and Experience

---

**ANRF NPDF, The Institute of Mathematical Sciences, India** Jan 2026 - present

**FARE Postdoc Fellow, Indian Institute of Technology Kanpur, India** Jan 2025 - Dec 2025

**Ph.D. in Physics, Indian Institute of Technology Kanpur, India** June 2025

Cumulative Performance Index (CPI): 9.5 (on a scale of 10)

Thesis: *Quantum phases and transport in twisted systems: effects of interactions and topology*

- Investigated broken symmetry phases at the interface of two twisted Weyl semimetals, identifying an excitonic supersolid ground state.
- Studied Josephson junction of minimally twisted bilayer graphene. Observed a  $4\pi$ -periodic Josephson current arising from the underlying zig-zag modes.
- Explored non-local resistance in minimally twisted bilayer graphene, linking zig-zag modes to unconventional resistance signatures, corroborated by recent experiments.

**M.Sc. in Physics, Indian Institute of Technology Kanpur, India** 2019

Cumulative Performance Index (CPI): 8.6 (on a scale of 10)

**B.Sc. in Physics with Honours, Calcutta University** 2017

Aggregate Percentage: 68%

## Research Interest

---

### Quantum Condensed Matter Physics

Moiré materials, correlated phenomena, quantum Hall effect, Josephson junctions, Floquet-engineering, quantum transport.

## Technical Skills

---

### Theoretical Techniques

**Many-Body Quantum Field Theory:** Hartree-Fock theory, diagrammatic perturbation theory, and Schwinger-boson mean-field theory.

**Moiré Systems:** Continuum model calculations for twisted multilayer graphene and multilayer graphene aligned with hBN.

**Quantum Transport:** Kubo formula and Landauer-Büttiker formalism for equilibrium transport: Hamiltonian and S-matrix approaches for static and Floquet (periodic) systems. Transport calculations on Chalker-Coddington network models.

**Non-Interacting Theories:** Hofstadter butterfly (also in moiré systems), Floquet-engineering, and theoretical approach to time-resolved ARPES (trARPES).

### Programming languages

Experienced with C++, Python, Mathematica, Julia, and Bash scripting.

- [1] A. Mukherjee, S. Layek, S. Sinha, **R. Kundu**, A. H. Marchawala, M. Hingankar, J. Sarkar, L. D. Sangani, H. Agarwal, S. Ghosh, et al., Superconducting magic-angle twisted trilayer graphene hosts competing magnetic order and moiré inhomogeneities, *Nat. Mater.* **24**, 1400–1406 (2025).
- [2] A. Dubey†, **R. Kundu**†, A. Kundu, Time-resolved ARPES and optical transport properties of irradiated twisted bilayer graphene in a steady state, *Phys. Rev. B* **111**, 035431, (2025).
- [3] **R. Kundu**, A. Kundu, Josephson junction of minimally twisted bilayer graphene, *Phys. Rev. B* **110**, 085422, (2024).
- [4] **R. Kundu**, H. A. Fertig, A. Kundu, Broken symmetry and competing orders in Weyl semimetal interfaces, *Phys. Rev. B* **107**, L041402, (2023).
- [5] R. Mukherjee, **R. Kundu**, A. Singh, A. Kundu, Schwinger-boson mean-field study of the spin-1/2  $J_1$ - $J_2$ - $J_\chi$  model in the honeycomb lattice: Thermal Hall signature, *Phys. Rev. B* **107**, 155122, (2023).
- [6] S. Mohapatra, **R. Kundu**, A. Dubey, D. Dutta, A. Singh, Role of orbital off-diagonal spin and charge condensates in a three orbital model for  $\text{Ca}_2\text{RuO}_4$ : Coulomb renormalized spin-orbit coupling, orbital moment, and tunable magnetic order, *J. Magnetism and Magnetic Materials* **537**, 168172, (2021).

## Awards

---

<b>National Postdoctoral Fellowship</b> Anusandhan National Research Foundation	Jan 2026 – Present
<b>Fellowship for Academic and Research Excellence</b> Indian Institute of Technology Kanpur	Jan 2025 – Dec 2025
<b>Prime Minister’s Research Fellow</b> MHRD, Government Of India <a href="#">Showcase of research-work</a>	2019–2024
<b>The Certificate of Merit</b> Indian Institute of Technology Kanpur For academic excellence in The Master of Science	2017

## Selected Schools and Conferences

---

<b>Synthetic Electronic Quantum Matter (SELEQ)</b> Broken symmetry and competing orders in Weyl semimetal interfaces with Fermi arc states DIPC, Donostia-San Sebastian, Spain (Poster presentation   in-person)	2024
<b>Workshop on Twistronics and Moiré Materials: Bridging Theory and Experiments</b> Josephson junction in minimally twisted bilayer graphene ICTP, Trieste, Italy (Poster presentation   in-person)	2024
<b>Condensed Matter meets Quantum Information</b> Broken symmetry and competing orders in Weyl semimetal interfaces with Fermi arc states ICTS, Bengaluru, India (Poster presentation   in-person)	2023
<b>APS March Meeting</b> SNS junction in small angle twisted bilayer graphene (Contributed talk   online)	2023

**Annual Conference on Quantum condensed Matter (QMAT)** 2022  
Broken symmetry and competing orders in Weyl semimetal interfaces with Fermi arc states  
IIT Kanpur, India (Poster presentation | volunteer | in-person)

**APS March Meeting** 2022  
Broken symmetry and competing orders in Weyl semimetal interfaces with Fermi arc states  
(Contributed talk | online)

## Teaching Activities

---

### Tutorials at NPTEL

- Advanced Condensed Matter Physics (Jan 2023-Mar 2023), [Youtube playlist](#).
- Advanced Quantum Mechanics with Applications (July 2022-Sept 2022), [Youtube playlist](#).

### Kendriya Vidyalaya

Conducted weekly problem-solving sessions for Class XII students at Kendriya Vidyalaya, IIT Kanpur Campus (2021).

### IIT Kanpur

- Advanced Statistical Mechanics, PHY613 (2024 odd semester at IITK | instructor: Adhip Agarwala).
- Under Graduate Lab, PHY101 (2021 odd semester at IITK).
- Quantum Many Body Physics , PHY607 (2020 even semester at IITK | instructor: Arijit Kundu).
- Condensed Matter Physics, PHY543 (2020 odd semester at IITK | instructor: Arijit Kundu).
- Electronics, PHY441 (2019 odd semester at IITK | instructor: Jayita Nayak).

## References

---

- **Prof. Arijit Kundu**  
Department of Physics, Indian Institute of Technology Kanpur, India-208016  
Email: [kundua@iitk.ac.in](mailto:kundua@iitk.ac.in)
- **Prof. Herbert A. Fertig**  
Department of Physics, Indiana University Bloomington, USA-47405  
Email: [hfertig@iu.edu](mailto:hfertig@iu.edu)
- **Prof. Mandar M. Deshmukh**  
Department of Condensed Matter Physics and Materials Science, Tata Institute of Fundamental Research, India-400005  
Email: [deshmukh@tifr.res.in](mailto:deshmukh@tifr.res.in)