

Archisman Panigrahi

Graduate Student (Ph.D. Candidate) · Physics

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Education

Ph.D. in Physics (ongoing)

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

• C.G.P.A - 5.0/5.0

Supervisor: Prof. Leonid Levitov

Cambridge, MA, USA

August 2022 - Ongoing

Master of Science in Physics

INDIAN INSTITUTE OF SCIENCE

• C.G.P.A - 9.8/10.0

Bangalore, India

Aug. 2021 - Jun. 2022

Bachelor of Science (Research) in Physics

INDIAN INSTITUTE OF SCIENCE

• C.G.P.A - 9.8/10.0

Bangalore, India

Aug. 2017 - Jun. 2021

Research Articles

LISTED IN THE CHRONOLOGICAL ORDER OF THEIR APPEARANCE ON ARXIV.

- **A. Panigrahi**, B. Roy; *Projected branes as platforms for crystalline, superconducting, and higher-order topological phases* [arXiv:2507.23783](#)
- **A. Panigrahi**, V. Poliakov, L. Levitov; *Tunneling density of states in exotic superconductors and spatial patterns of particle-hole interference* [arXiv:2503.16168](#)
- **A. Panigrahi**, A. Kumar; *Non-Fermi Liquids from Subsystem Symmetry Breaking in van der Waals Multilayers* [PRL **134**, 236502 \(2025\)](#)
- **A. Panigrahi**, V. Poliakov, Z. Dong, L. Levitov; *Spin chirality and fermion stirring in topological bands* [arXiv:2407.17433](#)
- L. Holleis, T. Xie, S. Xu, H. Zhou, C. L. Patterson, **A. Panigrahi**, T. Taniguchi, K. Watanabe, L. S. Levitov, C. Jin, E. Berg, A. F. Young; *Fluctuating magnetism and Pomeranchuk effect in multilayer graphene* [Nature **640**, 355–360 \(2025\)](#)
- M. Masseroni, M. Gull, **A. Panigrahi**, N. Jacobsen, F. Fischer, C. Tong, J. D. Gerber, M. Niese, T. Taniguchi, K. Watanabe, L. Levitov, T. Ihn, K. Ensslin, H. Duprez; *Spin-orbit proximity in MoS₂/bilayer graphene heterostructures* [Nat Commun **15**, 9251 \(2024\)](#)
- **A. Panigrahi**, L. Levitov; *Signatures of electronic ordering in transport in graphene flat bands* [PRB **110**, 035122 \(2024\)](#)
- **A. Panigrahi**, V. Juričić, B. Roy; *Projected Topological Branes* [Commun Phys **5**, 230 \(2022\)](#)
- **A. Panigrahi**, S. Mukerjee; *Energy magnetization and transport in systems with a non-zero Berry curvature in a magnetic field* [SciPost Phys. Core **6**, 052 \(2023\)](#)
- **A. Panigrahi**, R. Moessner, B. Roy; *Non-Hermitian dislocation modes: Stability and melting across exceptional points* [PRB **106**, L041302 \(2022\)](#)

Research Experience

Aspects of spin chirality and tunneling density of states in superconductors with broken time-reversal symmetry

WITH PROF. LEONID LEVITOV

MIT, Cambridge, MA, USA

2024 — Present

- Demonstrated that tunneling density of states near two impurities may be utilized to probe superconducting order parameter
- Demonstrated that spin chirality is spontaneously generated in time-reversal symmetry broken systems without any spin-orbit coupling
- Predicted that this effect can be utilized in detecting topological superconductors

Non-Fermi liquids resulting from subsystem symmetry breaking

WITH AJESH KUMAR

MIT, Cambridge, MA, USA

2024

- Demonstrated that subsystem symmetry breaking in van der Waals heterostructures can give rise to an anisotropic non-Fermi liquid, with quasiparticle lifetime $\tau \sim \frac{1}{|\omega| \log|1/\omega|}$ and specific heat $C \sim T[\log(1/T)]^2$.

Transport in ordered phases in graphene

WITH PROF. LEONID LEVITOV

MIT, Cambridge, MA, USA

2023 — 2024

- Predicted that momentum-polarized nematic phases in biased bilayer graphene can lead to resistance decreasing with rising temperature
- Demonstrated hysteresis-like switching behavior under the action of a strong electric field

Many Body Localization (MBL) and thermalization of interacting quantum spin chain

IISc, Bangalore, India

(Master's thesis)

September 2021 - April 2022

WITH PROF. SUBROTO MUKERJEE

- Studied how the Out-of-Time Ordered Correlator (OTOC) behaves for MBL and thermal systems
- Studied behavior of OTOC in MBL systems with random and incommensurate potential, with and without interaction

Topological phases in projected lower dimensional branes

MPIPKS, Dresden, Germany

(remotely)

June 2021 - September 2021

JOINTLY WITH PROF. BITAN ROY AND PROF. VLADIMIR JURIČIĆ

- Verified the existence of dislocation modes, Weyl points, and Landau levels in projected crystals and Fibonacci quasicrystals
- Proposed how this method can be utilized to study higher dimensional (>3D) topological phases within 3D systems

Berry curvature effects on thermoelectric transport

IISc, Bangalore, India

(Bachelor's thesis)

October 2020 - June 2021

WITH PROF. SUBROTO MUKERJEE

- Found a condition on the energy magnetization such that the Einstein relation holds for the transport energy current in these systems
- Analytically solved the Boltzmann transport equation (including Berry curvature effects) for two-dimensional systems

Non-Hermitian Topological Insulators and Dislocations

MPIPKS, Dresden, Germany

(remotely)

May 2020 - September 2020

WITH PROF. BITAN ROY

- Obtained phase diagrams for regimes where topological states get pinned at dislocation centers
- Proposed how dislocations can be used to probe topological phases in non-Hermitian systems, where the non-Hermitian skin effect masks the traditional bulk-boundary correspondence

Research Interests

Broadly interested in theoretical Condensed Matter Physics

- Non-Fermi Liquids emerging due to subsystem symmetry breaking
- Spin chirality in systems with spontaneously broken time-reversal symmetry
- Electronic transport in two-dimensional systems and the effects of Berry curvature in transport
- Computational methods in quantum condensed matter physics
- Topological phases of matter and Quantum Phase transitions

Skills

Programming skills Julia, MATLAB/Octave, Mathematica, Python

Advanced Physics Courses Strongly Correlated Systems, Advanced Statistical Physics, Quantum Field Theory I, General Relativity

Languages Fluent in English, Bengali, Hindi

Talks

Transport Signatures of Electronic Ordering in Graphene Flat Bands

Indian Institute of Science,

Bangalore, India

January 2024

CLICK [HERE](#) TO DOWNLOAD THE PRESENTATION

Topological phases in quasicrystals: A general principle of construction

APS March Meeting (virtually)

March 2022

CLICK [HERE](#) TO DOWNLOAD THE PRESENTATION

Dislocation as a bulk probe of non-Hermitian topology

MPIPKS, Dresden, Germany

(remotely)

July 6, 2021

CLICK [HERE](#) TO DOWNLOAD THE PRESENTATION

Teaching Experience

Physics II: Electricity and Magnetism

MIT

TEACHING ASSISTANT

Feb - May 2024

- Taught students one-on-one in office hours and graded exams

Academic Achievements

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|---------|--|--------------------|
| 2023 | Qualified among the top 16 participants in MIT Integration Bee | MIT |
| 2022 | 1st Rank in India in CSIR-NET (JRF) 2021 in Physics, held in February 2022 due to COVID (score 186/200) | India |
| 2022 | 1st Rank in India in Graduate Aptitude Test in Engineering (G.A.T.E.) in Physics | India |
| 2017-22 | CGPA 9.8/10 in B.S. (Research) and M.S., received Prof. R. Srinivasan Medal for highest CGPA in batch | IISc, Bangalore |
| 2017 | 1st rank (99.2 %) in Board in Higher Secondary Examination, among about 0.7 million candidates | West Bengal, India |
| 2015 | 2nd rank (97.57 %) in Board in Secondary Examination, among about 1 million candidates | West Bengal, India |

References

- Prof. **Leonid Levitov**, Dept. of Physics, Massachusetts Institute of Technology, Cambridge, MA 02139, USA.
Email Address - levitov@mit.edu
- Prof. **Subroto Mukerjee**, Dept. of Physics, Indian Institute of Science, Bangalore, India.
Email Address - smukerjee@iisc.ac.in
- Prof. **Bitan Roy**, Dept. of Physics, Lehigh University, Bethlehem, PA 18015, USA.
Email Address - bitan.roy@lehigh.edu