

# 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.

- P. Zhu, **A. Panigrahi**, L. Levitov, N. Trivedi; *Strain Response as a Probe of Spinons in Quantum Spin Liquids* [arXiv:2512.03137](https://arxiv.org/abs/2512.03137)
- **A. Panigrahi**, B. Roy; *Projected branes as platforms for crystalline, superconducting, and higher-order topological phases* [PRB \*\*113\*\*, 035301 \(2026\)](https://arxiv.org/abs/2407.17433)
- **A. Panigrahi**, V. Poliakov, L. Levitov; *Tunneling density of states in exotic superconductors and spatial patterns of particle-hole interference* [arXiv:2503.16168](https://arxiv.org/abs/2503.16168)
- **A. Panigrahi**, A. Kumar; *Non-Fermi Liquids from Subsystem Symmetry Breaking in van der Waals Multilayers* [PRL \*\*134\*\*, 236502 \(2025\)](https://arxiv.org/abs/2407.17433)
- **A. Panigrahi**, V. Poliakov, Z. Dong, L. Levitov; *Spin chirality and fermion stirring in topological bands* [arxiv:2407.17433](https://arxiv.org/abs/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 \(2025\)](https://arxiv.org/abs/2407.17433)
- 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 MoS<sub>2</sub>/bilayer graphene heterostructures* [Nat Commun \*\*15\*\*, 9251 \(2024\)](https://arxiv.org/abs/2407.17433)
- **A. Panigrahi**, L. Levitov; *Signatures of electronic ordering in transport in graphene flat bands* [PRB \*\*110\*\*, 035122 \(2024\)](https://arxiv.org/abs/2407.17433)
- **A. Panigrahi**, V. Juričić, B. Roy; *Projected Topological Branes* [Commun Phys \*\*5\*\*, 230 \(2022\)](https://arxiv.org/abs/2407.17433)
- **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 \(2023\)](https://arxiv.org/abs/2407.17433)
- **A. Panigrahi**, R. Moessner, B. Roy; *Non-Hermitian dislocation modes: Stability and melting across exceptional points* [PRB \*\*106\*\*, L041302 \(2022\)](https://arxiv.org/abs/2407.17433)

## Research Experience

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

MIT, Cambridge, MA, USA

WITH PROF. LEONID LEVITOV

2024 — Present

- Demonstrated that tunneling density of states near two impurities may be utilized to probe 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 phase winding

### Non-Fermi liquids resulting from subsystem symmetry breaking

MIT, Cambridge, MA, USA

WITH AJESH KUMAR

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

MIT, Cambridge, MA, USA

WITH PROF. LEONID LEVITOV

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
- Role of Berry curvature in coherent phenomena
- 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

### Tunneling density of states in exotic superconductors and spatial patterns of particle-hole interference

APS March Meeting, Anaheim, CA

CLICK [HERE](#) TO DOWNLOAD THE PRESENTATION

March 2025

### 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)

CLICK [HERE](#) TO DOWNLOAD THE PRESENTATION

March 2022

### Dislocation as a bulk probe of non-Hermitian topology

MPIPKS, Dresden, Germany

(remotely)

July 6, 2021

CLICK [HERE](#) TO DOWNLOAD THE PRESENTATION

## Teaching Experience

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### Physics II: Electricity and Magnetism

TEACHING ASSISTANT

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

MIT

Feb - May 2024

## Academic Achievements

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

## References

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- Prof. **Leonid Levitov**, Dept. of Physics, Massachusetts Institute of Technology, Cambridge, MA 02139, USA.  
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- 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