Archisman Panigrahi

Graduate Student (Ph.D. Candidate) · Physics

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Education

Ph.D. in Physics

Cambridge, MA, USA

Massachusetts Institute of Technology

August 2022 - Ongoing

- C.G.P.A - $5.0/5.0$

Supervisor: Prof. Leonid Levitov

Master of Science in Physics

Bangalore, India

Indian Institute of Science

Aug. 2021 - Jun. 2022

- C.G.P.A - $9.8/10.0$

Bachelor of Science (Research) in Physics

Bangalore, India

Indian Institute of Science

Aug. 2017 - Jun. 2021

- C.G.P.A - $9.8/10.0$

Research Articles

- **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; *Isospin Pomeranchuk effect and finite temperature resistivity minimum in rhombohedral graphene* arxiv:2407.13763
- **A. Panigrahi**, L. Levitov; *Signatures of electronic ordering in transport in graphene flat bands* Phys. Rev. B **110**, 035122 (2024)
- 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_2/bilayer graphene heterostructures* arxiv:2403.17120
- **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**, V. Juričić, B. Roy; *Projected Topological Branes* Commun Phys **5**, 230 (2022)
- **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 in time-reversal symmetry broken systems

MIT, Cambridge, MA, USA

With Prof. Leonid Levitov

2024 — Present

- Demonstrated that spin chirality is spontaneously generated in time-reveral symmetry broken systems without any spin-orbit coupling

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)

With Prof. Subroto Mukerjee

September 2021 - April 2022

- 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)

Jointly with Prof. Bitan Roy and Prof. Vladimir Juričić

June 2021 - September 2021

- 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)

With Prof. Subroto Mukerjee

October 2020 - June 2021

- Studied how Berry curvature can alter thermoelectric transport, leading to anomalous Hall and anomalous Nernst effects
- 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)

With Prof. Bitan Roy — *May 2020 - September 2020*

- Studied the effects of dislocation in Hermitian and Non-Hermitian Chern Insulators
- 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

- **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**
- **Thermalization of quantum systems and Many body localization**

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

Click here to download the presentation — *January 2024*

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)

Click here to download the presentation — *July 6, 2021*

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

2023	Qualified among the top 16 participants in MIT Integration Bee	*MIT*
2022	**1st Rank in India** in CSIR-NET (JRF) in Physics (score 186/200)	*India*
2022	**1st Rank in India** in Graduate Aptitute Test in Engineering (G.A.T.E.) in Physics	*India*
2017-22	**C.G.P.A** 9.8/10 in B.S. (Research) and M.S., 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