Archisman Panigrahi

Graduate Student · Physics
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Education

Ph.D. in Physics
Cambridge, MA, USA
Massachusetts Institute of Technology
August 2022 - Ongoing

Master of Science in Physics
Bangalore, India
Indian Institute of Science
Aug. 2021 - Jun. 2022
- C.G.P.A - $9.8/10$

Bachelor of Science (Research) in Physics
Bangalore, India
Indian Institute of Science
Aug. 2017 - Jun. 2021
- C.G.P.A - $9.8/10$

Higher Secondary Examination (XII^{th} standard)
West Bengal Council of Higher Secondary Education, India
Hooghly Collegiate School
2015 - 2017
- Obtained 1^{st} rank in Board, among about 0.7 million candidates

Secondary Examination (X^{th} standard)
West Bengal Board of Secondary Education , India
Hooghly Collegiate School
2005 - 2015
- Obtained 2^{nd} rank in Board, among about 1 million candidates

Achievements

2022	**1st Rank in India** in CSIR-NET (JRF) in Physics	*India*
2022	**1st Rank in India** in Graduate Aptitude 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 GPA in batch	*IISc, Bangalore*
2017	**1st rank (99.2 %) in Board** in Higher Secondary Examination	*West Bengal, India*
2017	10th rank in National Entrance Screening Test (NEST)	*India*
2017	Qualified for JEE Mains (All India Rank - 381) - an all India Engineering entrance	
2017	Qualified for JEE Advanced examination (All India Rank- 543), Entrance examination of Indian Institute(s) of Technology (IIT)	
2017	Qualified for Indian Statistical Institute, Kolkata and Chennai Mathematical Institute	
2015	Qualified for K.V.P.Y. (All India Rank - 128)	
2015	**2nd rank (97.57 %) in Board** in Secondary Examination	*West Bengal, India*

Research Articles

Published Articles
- **A. Panigrahi**, R. Moessner, B. Roy; *Non-Hermitian dislocation modes: Stability and melting across exceptional points* (2022) PRB **106**, L041302

Preprints
- **A. Panigrahi**, V. Juričić, B. Roy; *Projected Topological Branes* (2021) arXiv:2112.06911 (Accepted in *Communications Physics* in August 2022)
- **A. Panigrahi**, S. Mukerjee; *Energy magnetization and transport in systems with a non-zero Berry curvature in a magnetic field* (2021) arXiv:2111.08026 (Under peer review in *Scipost Physics*)

Talks

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

Research Interests

Broadly interested in theoretical Condensed Matter Physics

- **Topological phases of matter and Quantum Phase transitions**
- **Thermo-electric transport and the effects of Berry curvature**
- **Brownian motion**
- **Thermalization of quantum systems and Many body localization**

Skills

Mathematical skills	Integral Calculus, Linear Algebra, Trigonometry, Differential Equations
	Comfortable with performing long algebraic calculations in pen and paper
Programming skills	MATLAB/Octave, Mathematica, Python, Data structures in C
Advanced Physics Courses	Condensed Matter Physics II, Advanced Statistical Physics, Quantum Field Theory I, General Relativity
Languages	Fluent in English, Bengali, Hindi

Research Experience

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

- Numerically studied how topological properties of parent systems emerge in projected crystals and Fibonacci quasicrystals
- Verified the existence of dislocation modes, Weyl points, and Landau levels in projected crystals and 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

- Studied how Berry curvature can alter thermoelectric transport, leading to anomalous Hall and anomalous Nernst effects
- Studied the Boltzmann transport formalism
- Studied how the Onsager relation can be demonstrated from microscopic theories for a system with a non-trivial Berry curvature
- Found a condition on the energy magnetization such that the Einstein relation holds for the transport energy current in these systems
- Showcased a physical interpretation of this condition, and obtained a closed expression for energy magnetization
- 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

- Studied and numerically implemented SSH Model, Chern Insulators, Quantum Spin Hall Insulators
- 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

Nano Heat Engines beyond the Carnot Efficiency

IISc, Bangalore, India
May 2019 - July 2019

WITH PROF. H. R. KRISHNAMURTHY

- Studied how harmonic oscillators and two state systems can be used as efficient heat engines
- Read articles claiming Carnot efficiency can be surpassed with "squeezed" thermal baths
- Figured out the sense in which Carnot efficiency is surpassed without violating 2nd law of thermodynamics
- Studied about Brownian Motion and Langevin equation
- Solved the Langevin equation for a special kind of stochastic force, for which a classical harmonic oscillator behaves like a squeezed state
- Created a computer simulation to verify the nature of this solution

References

- 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
- Prof. **Hulikal Ramaiengar Krishnamurthy**, Dept. of Physics, Indian Institute of Science, Bangalore, India.
  Email Address - hrkrish@iisc.ac.in