

Archisman Panigrahi

5th Year · UG · Physics Major

Indian Institute of Science, Bangalore, India

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Education

Master of Science in Physics

INDIAN INSTITUTE OF SCIENCE

- Ongoing

Bangalore, India

Aug. 2021 - May 2022 (expected)

Bachelor of Science (Research) in Physics

INDIAN INSTITUTE OF SCIENCE

- C.G.P.A - 9.8/10

Bangalore, India

Aug. 2017 - Jun. 2021

Higher Secondary Examination (XIIth standard)

HOOGHLY COLLEGIATE SCHOOL

- Obtained 1st rank in Board, among about 0.7 million candidates

West Bengal Council of Higher

Secondary Education, India

2015 - 2017

Secondary Examination (Xth standard)

HOOGHLY COLLEGIATE SCHOOL

- Obtained 2nd rank in Board, among about 1 million candidates

West Bengal Board of Secondary

Education, India

2005 - 2015

Achievements

2017-21 **C.G.P.A 9.8/10** in B.S. (Research), 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

PREPRINT(S)

- **A. Panigrahi**, R. Moessner, B. Roy; *Non-Hermitian dislocation modes: Stability and melting across exceptional points* (2021) [arXiv:2105.05244](#)
- **A. Panigrahi**, S. Mukerjee; *Energy magnetization and transport in systems with a non-zero Berry curvature in a magnetic field* (2021) [arXiv:2111.08026](#)

MANUSCRIPTS IN PREPARATION

- **A. Panigrahi**, V. Juričić, B. Roy; *Emergence of topological properties of parent crystals in projected topological branes.*

Talks

Dislocation as a bulk probe of non-Hermitian topology

MPIPKS, Dresden, Germany

(remotely)

PRESENTATION DOWNLOAD LINK

July 6, 2021

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, Data structures in C
Advanced Physics Courses	Condensed Matter Physics II, Advanced Statistical Physics, Quantum Field Theory I, Relativistic Q.M. (ongoing)
Languages	Fluent in English, Bengali, Hindi

Ongoing Research Projects

Many body localization and thermalization of quantum systems

WITH PROF. SUBROTO MUKERJEE

IISc, Bangalore, India

(Bachelor's thesis)

September 2021 - Present

Research Experience

Topological phases in projected lower dimensional branes

JOINTLY WITH PROF. BITAN ROY AND PROF. VLADIMIR JURIČIĆ

MPIPKS, Dresden, Germany

(remotely)

June 2021 - September 2021

- 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 these systems can be utilized to study higher dimensional (>3D) topological phases within 3D systems

Berry curvature effects on thermoelectric transport

WITH PROF. SUBROTO MUKERJEE

IISc, Bangalore, India

(Bachelor's thesis)

October 2020 - June 2021

- Studied how Berry curvature can alter thermoelectric transport, leading to anomalous Hall and anomalous Nernst effects
- Studied the Boltzmann transport formalism
- Studied how the existence of 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
- Found a physical interpretation of this condition, and obtained a closed expression for energy magnetization using this condition
- Analytically solved the Boltzmann transport equation (including Berry curvature effects) for two-dimensional systems

Non-Hermitian Topological Insulators and Dislocations

WITH PROF. BITAN ROY

MPIPKS, Dresden, Germany

(remotely)

May 2020 - September 2020

- Studied and numerically implemented SSH Model, Chern Insulators, Quantum Spin Hall Insulators
- Studied effects of dislocation in Hermitian and Non-Hermitian Chern Insulators
- Noticed similarity between plot of a quantity I analytically calculated, and a phase diagram in a paper (in a different context), from which I found a new interpretation of that phase transformation
- 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

WITH PROF. H. R. KRISHNAMURTHY

IISc, Bangalore, India

May 2019 - July 2019

- Studied how harmonic oscillators and two state systems can be used as efficient heat engines
- Read Articles claiming they surpassed Carnot efficiency with "squeezing", and figured out the sense in which Carnot efficiency is surpassed
- Studied how one can produce such a squeezed state of a harmonic oscillator using "squeezed thermal bath"
- Studied about Brownian Motion and Langevin equation
- Solved the Langevin equation for a special kind of random 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