# Archisman Panigrahi

5<sup>th</sup> 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

**Bachelor of Science (Research) in Physics** 

Indian Institute of Science

• C.G.P.A - 9.8/10

**Higher Secondary Examination (**XII<sup>th</sup> **standard)** 

HOOGHLY COLLEGIATE SCHOOL

• Obtained 1<sup>st</sup> rank in Board, among about 0.7 million candidates

**Secondary Examination** ( $X^{th}$  standard)

HOOGHLY COLLEGIATE SCHOOL

• Obtained  $2^{nd}$  rank in Board, among about 1 million candidates

Bangalore, India

Aug. 2021 - May 2022 (expected)

Bangalore, India

Aug. 2017 - Jun. 2021

West Bengal Council of Higher

Secondary Education, India

2015 - 2017

West Bengal Board of Secondary

Education, India

2005 - 2015

# **Achievements**

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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

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## 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
- A. Panigrahi, V. Juričić, B. Roy; *Projected Topological Branes* (2021) arXiv:2112.06911

## Talks

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

CLICK HERE TO DOWNLOAD THE PRESENTATION

MPIPKS, Dresden, Germany (remotely)

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



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 interacting quantum spin chains

IISc, Bangalore, India (Bachelor's thesis) September 2021 - Present

WITH PROF. SUBROTO MUKERJEE

# **Research Experience**

## **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)

WITH PROF. SUBROTO MUKERJEE 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 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

May 2020 - September 2020

(remotely)

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

WITH PROF. H. R. KRISHNAMURTHY

May 2019 - July 2019

- 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 2<sup>nd</sup> 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