

# 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

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 (XII<sup>th</sup> standard)

HOOGHLY COLLEGIATE SCHOOL

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

West Bengal Council of Higher

Secondary Education, India

2015 - 2017

### Secondary Examination (X<sup>th</sup> standard)

HOOGHLY COLLEGIATE SCHOOL

- Obtained 2<sup>nd</sup> 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.PY (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 Fibonacci quasicrystals*

## 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
- Brownian motion
- Thermalization of quantum systems and Many body localization

## Skills

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**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

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### Many body localization and thermalization of quantum systems

WITH PROF. SUBROTO MUKERJEE

IISc, Bangalore, India

(Bachelor's thesis)

September 2021 - Present

## Research Experience

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### Topological phases in Quasicrystals

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 Fibonacci quasicrystals
- Verified the existence of dislocation modes, Weyl points, and Landau levels in quasicrystals

### 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 Berry curvature in reciprocal space
- Found a condition on the energy magnetization such that the Einstein relation holds for the transport energy current in the above type of 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 disturbs 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

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- Prof. **Subroto Mukerjee**, Dept. of Physics, Indian Institute of Science, Bangalore, India.  
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- Prof. **Bitan Roy**, Dept. of Physics, Lehigh University, Bethlehem, PA 18015, USA.  
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- Prof. **Hulikal Ramaiengar Krishnamurthy**, Dept. of Physics, Indian Institute of Science, Bangalore, India.  
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