

Archisman Panigrahi

5th Year · UG · Physics Major

Indian Institute of Science, Bangalore, India

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Education

Bachelor of Science (Research) in Physics

INDIAN INSTITUTE OF SCIENCE

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

Bangalore, India

Aug. 2017 - Jun. 2021

Master of Science in Physics

INDIAN INSTITUTE OF SCIENCE

- Ongoing

Bangalore, India

Aug. 2021 - May 2022 (expected)

Research Experience

Topological phases in Quasicrystals

JOINTLY WITH PROF. BITAN ROY AND PROF. VLADIMIR JURIČIĆ

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

(remotely)

June 2021 - October 2021

Berry curvature effects on thermoelectric transport

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 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

IISc, Bangalore, India

October 2020 - June 2021

Non-Hermitian Topological Insulators and Dislocations

WITH PROF. BITAN ROY

- 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

MPIPKS, Dresden, Germany

(remotely)

May 2020 - September 2020

Nano Heat Engines

WITH PROF. H. R. KRISHNAMURTHY

- 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

IISc, Bangalore, India

May 2019 - July 2019

Articles

PREPRINT(S)

- **A. Panigrahi**, R. Moessner, B. Roy; *Non-Hermitian dislocation modes: Stability and melting across exceptional points* (2021) [arXiv:2105.05244](https://arxiv.org/abs/2105.05244)

MANUSCRIPTS IN PREPARATION

- **A. Panigrahi**, S. Mukerjee; *Berry curvature effects on the energy magnetization as a consequence of the Einstein relation*
- **A. Panigrahi**, V. Juričić, B. Roy; *Emergence of topological properties of parent crystals in Fibonacci quasicrystals*

Invited Talks

Dislocation as a bulk probe of non-Hermitian topology

PRESENTATION DOWNLOAD LINK

MPIPKS, Dresden, Germany

(remotely)

July 6, 2021

Skills

Mathematical skills Integral Calculus, Linear Algebra, Trigonometry, Differential Equations

Comfortable with performing long algebraic calculations in pen and paper

Programming skills Familiar with MATLAB/Octave, Mathematica, Data structures in C

Advanced Physics Courses Advanced Condensed Matter, Advanced Statistical Mechanics, Relativistic Q.M., Quantum Field Theory I

Languages Fluent in English, Bengali, Hindi

Topics of Interest

- Theoretical Condensed Matter Physics
- Topological phases
- Brownian Motion
- Phase transitions and applications of statistical field theory

Achievements

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

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

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 - bir218@lehigh.edu
- Prof. **Hulikal Ramaiengar Krishnamurthy**, Dept. of Physics, Indian Institute of Science, Bangalore, India.
Email Address - hrkrish@iisc.ac.in