Archisman Panigrahi

5th Year · UG · Physics Major
Indian Institute of Science, Bangalore, India
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Education

Bachelor of Science (Research) in Physics
Bangalore, India

Indian Institute of Science
Aug. 2017 - Jun. 2021

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

Master of Science in Physics
Bangalore, India

Indian Institute of Science
Aug. 2021 - May 2022 (expected)

- Ongoing

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, 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*

Projects

Various topics related to Topological Insulators

(remotely)

Jointly with Prof. Bitan Roy and Prof. Vladimir Juričić — *June 2021 - October 2021*

- 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

Berry curvature effects on thermoelectric transport

IISc, Bangalore, India

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 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

Various topics related to Topological Insulators

MPIPKS, Dresden, Germany
(remotely)

With Prof. Bitan Roy — *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

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 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

Articles

Preprint(s)

- **A. Panigrahi**, R. Moessner, B. Roy; *Non-Hermitian dislocation modes: Stability and melting across exceptional points* (2021) arXiv: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*

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.
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