Archisman Panigrahi

4th year Undergraduate · Physics Major
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Education

B.S. (Research) in Physics

Bangalore, India

Indian Institute of Science

Aug. 2017 - Apr. 2021 (expected)

- Current C.G.P.A - $9.7/10$

Higher Secondary Examination (XII^{th} standard)

West Bengal Counsil of Higher Secondary Education, India

Hooghly Collegiate School

2015 - 2017

- Obtained 1^{st} rank in Board

Secondary Examination (X^{th} standard)

West Bengal Board of Secondary Education , India

Hooghly Collegiate School

2005 - 2015

- Obtained 2^{nd} rank in Board

Skills

Mathematical skills Integral Calculus, Linear Algebra, Trigonometry, Differential Equations
Comfortable with performing long algebraic calculations

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

Languages Fluent in English, Bengali, Hindi

Topics of Interest

- **Theoretical Condensed Matter Physics**
- **Emergent phenomena in Condensed Matter due to topological effects**
- **Brownian Motion**
- **Statistical field theory and its applications**
- **Phase transitions**

Achievements

2017-20	**C.G.P.A** 9.7/10	*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 Institutes 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 on 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 effect of dislocation in Hermitian and Non-Hermitian Chern Insulators
- Studied how dislocation modes can be protected by symmetry
- 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

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

Various topics on the Special Theory of Relativity

IISc, Bangalore, India

With Prof. Subroto Mukerjee — *May 2018 - June 2018*

- Studied basics of Special theory of relativity - four vector notation, Lorentz transformations, relativistic momentum and energy
- Studied how electric and magnetic field behave under change of reference frames
- Worked out a detailed example of how a signal travelling faster than light can violate causality (see *Articles* section below)
- Studied relativistic Doppler effect of an electromagnetic wave travelling in a medium

Articles

These are some articles I have written (not published anywhere, click on the title to download)

- A Study of Generation of Classical Squeezed States Using Stochastic Force, and their Applications in Building Highly Efficient Heat Engines (2019)
- Review article - A detailed example of how causality is violated when information travels faster than speed of light in vaccum (2018)
- Review article - Doppler effect of electromagnetic waves in refractive medium (2018)
- A Geometric Method to obtain Harmonic Mean of Two numbers (2016)

Relevant Courses Taken

Textbooks are given in brackets to indicate the level of the course

Semester I

- **Introductory Physics I – Mechanics, Oscillations and Waves** (An Introduction to Mechanics - **Kleppner & Kolenkow**)
- **Analysis and Linear Algebra I** (Calculus, Volume I - **Apostol**; Linear Algebra and its Applications - **Strang**)
- **Algorithms and Programming (in C)**

Semester II

- **Introductory Physics II – Electricity, Magnetism and Optics** (Introduction to Electrodynamics by **David J. Griffiths**)
- **Analysis and Linear Algebra II** (Calculus, Volume II - **Apostol**; Linear Algebra and its Applications - **Strang**)
- **Introduction to Electrical and Electronics Engineering**

Semester III

- **Introductory Physics Ill - Thermal and Modern Physics** (Thermodynamics - **Enrico Fermi**; Fundamentals of Physics - **Halliday**, **Resnick** and **Walker**; PHYSICS For Scientists and Engineers - **Serway & Jewett**)
- **Probability and Statistics** (An Introduction to Probability Theory and its Applications - Vol. I - **Feller**; Intoduction to Probability and Statistics for Scientists and Engineers)
- **Introduction to Materials Science (Thermodynamics in Materials Science - DeHoff)**

Semester IV

- **Intermediate Mechanics, Oscillations and Waves** (The **Feynman** Lectures, Vol I,II;)
- **Intermediate Electromagnetism and the Quantum Physics of Radiation** (The **Feynman** Lectures, Vol I,II; Introduction to Electrodynamics by **David J. Griffiths**)
- **Intermediate Thermal Physics and the Physics of Materials** (Thermodynamics and Introduction to Thermostatistics - **Callen**; Fundamentals of Statistical and Thermal Physics - **F. Reif**)
- **Numerical methods for solving differential equations**

Semester V

- **Classical Mechanics** (Classical Mechanics - **Goldstein**; Mechanics **Landau and Lifshitz**)
- **Quantum Mechanics I** (Quantum Mechanics - **Cohen-Tannoudji, Diu** and **Laloe**; Principles of Quantum Mechanics - **Shankar**)
- **Mathematical Methods of Physics** (Mathematics for Physicists - **Dennery** and **Krzywicki**; Mathematical Methods for Physicists - **Arfken, Weber** and **Harris**)
- **Fundamentals of Astrophysics** (Astrophysics for Physicists - **Rai Choudhuri**; Astrophysics in a Nutshell - **Maoz**)
- **Solid State Physics** (The Oxford Solid State Basics - **Simon**, Solid State Physics - **Ashcroft & Mermin**)

Semester VI

- **Statistical Mechanics** (Statistical Physics of Particles - **Kardar**)
- **Quantum Mechanics II** (Quantum Mechanics - **Schwabl**, Principles of Quantum Mechanics - **Shankar**)
- **Quantum Measurements** (Quantum Measurement - **Braginsky**, **Khalili**, **Thorne**)
- **Electromagnetic Theory** (Classical Electrodynamics - **Jackson**)
- **Physics at Nanoscales** (Quantum Transport - Atom to transistor - **Datta**, Electronic transport in mesoscopic systems - **Datta**)
- **Quantum Computation** (Audited)

Semester VII (going on)

- **Advanced Condensed Matter Physics** (Solid State Physics - **Ashcroft & Mermin**, Principles of Condensed Matter Physics - **Chaikin & Lubensky**)
- **Advanced Statistical Mechanics** (Statistical Physics of Fields - **Kardar**, Principles of Condensed Matter Physics - **Chaikin & Lubensky**)
- **Quantum Field Theory I** (Quantum Field Theory - **Srednicki**, Quantum Field Theory and the Standard Model - **Schwartz**, Quantum Field Theory for the Gifted Amateur - **Lancaster** and **Blundell**)

References

- Prof. **Hulikal Ramaiengar Krishnamurthy**, Dept. of Physics, Indian Institute of Science, Bangalore.
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