Shihabul Haque

Integrated BS MS student (Physics Major)
Indian Association for the Cultivation of Science, Kolkata (IACS)
Mail: Shihabul Haque (alternative: ug2020sh2371@iacs.res.in)

EDUCATION

Indian Association for the Cultivation of Science, Kolkata - Integrated BS MS - Physics major

2020 - 2025

CGPA: **9.49/10.00** (as of semester 6)

Relevant coursework: Lagrangian & Hamiltonian formalisms, Quantum Mechanics, Statistical Mechanics, Thermodynamics, Electrodynamics (classical field theory formalism), Group theory.

South Point High School, Kolkata - CBSE 12th

APRIL 2018 - MARCH 2020

Percentage: **95%** (98 in physics and 97 in Math)

Subjects: Physics, Chemistry, Biology, Math, English

South Point High School, Kolkata - CBSE 10th

APRIL 2017 - MARCH 2018

Percentage: **96.6%** (96 in science and 95 in Math)

PREVIOUS EXPERIENCE

Chennai Mathematical Institute, Chennai (CMI) - *Department of Physics*

June 2023 - July 2023

Supervisor: H. S. Mani, Adjunct Professor

I was involved in a summer project on quantum foundations, specifically quantum measurement theory, looking into the idea of a “weak” measurement. I looked at projective measurements and weak values and a bit of how our conceptual understanding of the idea evolved over time.

I worked on a straightforward example, calculating weak values for a spin 1 system, and looked more comprehensively into the conceptual idea of a weak measurement and its relation to interference and the quantum nature of matter, extending the approach in *Sokolovski et. al*. to a more general setting and explicitly calculating the weak values in a few simple quantum systems. I also looked at further applications of the weak measurements - for example, its relation to non-Hermitian and non-normal operators and entanglement detection. Apart from this, I also, very briefly, looked into the idea of non-Hermitian (PT symmetric) Hamiltonians.

Indian Association for the Cultivation of Science, Kolkata (IACS) - *School of Physical Sciences*

December 2021 - April 2023

Supervisor: Jayanta K. Bhattacharjee, Emeritus Professor *(now at Indian Institute of Technology, Kanpur)*

I was involved in a long term work on nonlinear systems and resonant behavior. I learnt about different approximating techniques, perturbative techniques, dealing with diverging quantities and applied these ideas to physical systems.

I have worked on parametric resonances in a certain type of pendulum, leading to some interesting and new results. The above work was presented at the **NODYCON, 2023**, in Rome by me (online). Specifically, we derived multiple parametric resonance conditions for the system and looked into the numerical solutions of the same at those conditions along with a brief foray into the chaotic aspects of the same.

I have also worked on the idea of resonances in forced and parametric oscillators, specifically in the context of their finite responses using perturbative expansions. The crux of this work is summarized in the arXiv preprint **here**.

Rajabazar Science College, Kolkata - *Department of Physics*

May 2022 - August 2022

Supervisor: Amitava Raychaudhuri, Professor Emeritus

A brief summer project on neutrino mass models. I looked at the Dirac equation and explored the idea of spinors, gamma matrices, chirality, and a bit of the seesaw mechanism. I mostly learnt about neutrinos from an introductory particle physics perspective starting from the covariant formulation of the Dirac equation and looking into various other ideas concerning SU(2), spinors and their transformations, chirality and helicity and so on.

National Central University, Taiwan - *Department of Physics*

April 2022 - PRESENT (online)

Supervisor: Prof. Otto C.W. Kong

Reading project on the mathematical background needed for fundamental physics, specifically quantum physics. I am involved in learning about the basics of abstract algebras, Hamiltonian flows and the specialization of the supervisor (noncommutative quantum physics). However, progress has been slow due to the advanced background necessary and added focus on other projects and coursework.

Indian Institute of Technology, Kanpur - *Physical Sciences Department*

October 2021 - March 2022 (online)

Supervisor: Prof. Tapobrata Sarkar

A brief reading project on strong gravity effects like lensing. Involved reading on black bounces, photon spheres, trying out Mathematica and some associated packages. I also learnt a bit about the mathematical language of the topic.

Apart from this, I have also written 2 term papers as part of my coursework (on *"The solar neutrino problem"* and *"The double slit experiment in classical and quantum mechanical contexts"*). I have also self learnt **Julia** as a side project/hobby and have used it for different projects (like the one presented at NODYCON, 2023).

TECHNICAL SKILLS

Computational: Julia, Origin, Python, Desmos. **Markup:** LaTeX

Laboratory: Have attended general physics and digital electronics laboratory courses.

FELLOWSHIPS

I am primarily funded by the **KVPY** fellowship provided by the DST, Government of India. Thus, I am not eligible for other state-sponsored scholarships (but not private ones).

ACADEMIC ACCOLADES AND OTHER ACHIEVEMENTS

1. Qualified the first stage of **JBNSTS, 2020**, a scholarship competition for science students from West Bengal, India.
2. Ranked **61** worldwide in Open Category (O) in the **Physics Brawl Online**, an international physics team competition.
3. **Zonal Toppers** (Kolkata), **Mimamsa 2022**, a national level open book team-based science competition.
4. Completed an astronomy course organized by the **Breakthrough Science Society, Kerala Chapter**.
5. Ranked **6th** in the In Search of Young Ruskin Bond Contest, a national level short story writing competition, in 2019.
6. Bagged **Gold Medal** in the Don Bosco Jubilee Quiz 2015. Represented my school in the Bournvita Quiz.
7. Took part in public speaking and quizzing during school years along with karate and yoga. I was also a member of the activity club, learning the violin for nearly a decade.
8. Participated in a summer camp by **The British Council** (2014).

PRESENTATIONS, PUBLICATIONS & PREPRINTS

Presentations:

1. *An extensible double pendulum and multiple parametric resonances* - NODYCON, 2023, Rome (abstract available here).

Publications/Preprints:

1. *Interference aided finite resonant response in an undamped forced oscillator* - arXiv preprint (available here).
