

My aim for pursuing theoretical physics, started to grow roots by the end of the first year. In the first year I concentrated mainly on the courses. I was awarded the Institute Academic Award by IIT Bombay for standing 3rd in the institute among a batch of 900 students and 1st in the Department of Physics among a batch of 42 students. Currently I stand second in the institute. At this nascent stage, I didn't opt for a research project in the summers between the first and second years. Instead I spent the summers learning Functional Analysis, Calculus of variations and Special Relativity. I studied the applications of these three topics in theoretical physics-classical mechanics, general relativity and quantum mechanics. This gave a further impetus to pursue theoretical physics.

My first theoretical research experience came in winter 2016. I was selected as one of thirteen students to participate in the National Program for Differential Equations - Theory, Computation and Analysis (NPDE-TCA) held at IIT Bombay. I was assigned to work under Prof. Neela Nataraj, Head of Department, Mathematics Department. In order to conform to my interest in physics, the project topic chosen by my advisor was "Multistability in liquid crystals". The aim of the project was to study what drives normal bistable liquid crystals into multistability. This was done under the Landau-de Gennes free energy framework. Minimisation of the energy functional was carried out on MATLAB. Hence, numerical techniques like Finite Elements Method (in 2D) and Newton-Galerkin approximation were used. For a particular ground state (of the 6 obtained), consistency conditions were carried out which showed an expected decrease in the error values that had also been calculated.

In my fifth semester, I decided to take courses in General Topology and the General Theory of Relativity. I tried reading on my own the connections between Differential Geometry, Topology and General Relativity. The abstraction of Topology coupled with the magnificence of Einstein's General Relativity left an everlasting impression. I started tilting towards Gravity and String Theory in theoretical physics after taking up these two courses.

In the second year summers, I was selected to work with the String group at the International Centre for Theoretical Sciences, (ICTS-TIFR), Bengaluru as part of an 8 weeks SN Bhatt Memorial Excellence Fellowship Program. I was among the twenty selected from all over India. I was assigned to work with Dr .Pallab Basu on "Confinement: Instantons, Solitons and Monopoles in Non Abelian Gauge theories". A major part of the project was spent on learning the instantons of the Yang-Mills theory. This was followed up by studying Symmetry breaking, Nambu-Goldstone's Bosons, Goldstone's theorem, Higgs boson and the Higgs mechanism. The project ended with learning about Solitons and the Polyakov and BPST monopoles.

During the course of 8 weeks, I took part in the "String Lunches" that were organised in which recent papers published by the String community were discussed. I also regularly gave presentations about the work I had done. Regular interactions with Dr. R.Loganayagam and other members of the String group helped me a lot to feel and experience what research in String theory felt like. I also attended regular talks given by the String group and people invited from other institutes, most notably Sir John Ellis and Prof. Sumit Das. These, along with the

String lunches, gave me an idea of the active research areas in string theory that people were working on.

As a follow-up of the work I had done at ICTS, I decided to continue to work further in this area of physics. In my third year, I have taken a course in Quantum Field theory, now on the verge of completion under the guidance of Dr. Loganayagam (ICTS) and Prof. Ramadevi (IIT Bombay). In this course, I have covered path integral approach, Perturbation theory, Feynman diagrams, Diagrammatic Schwinger Dyson equation Scattering matrix, Second Quantization and Lorentz group Representations.

As part of my course projects, I have done a project on “Chaos in Cryptography” in Nonlinear Dynamics. I was also part of a 4-member team for “synthesising music using Python”. This was part of the Waves and Oscillations course.

I have also done a fair amount of laboratory and electronics work. I along with a colleague designed a “3-Body Collider simulator” on an FPGA board in VHDL. We are also in the midst of designing “A 2D Topology mapping device”. This is being done using Arduino and an ultrasonic sensor for distance measurement.

As part of my coursework, I have completed a number of important courses: Relativistic Quantum mechanics and Quantum Field theory, Special and General Relativity, General Topology, Classical Mechanics, Electrodynamics, Nonlinear Dynamics, Real, Complex and numerical Analysis, Partial and ordinary differential equations, Data Analysis, Thermodynamics, Waves, Oscillations and optics and Photonics.

While I have enjoyed doing these course projects a lot, none touched me more than the summer research project I did at ICTS. Fresh after General Topology and General relativity, it offered a beautiful continuation of two beautiful courses. It, along with these two courses combined abstraction, beauty and practicality in a single package.

Currently my interests lie in the Mathematical aspects of Quantum Field Theory and String Theory. However, at this nascent stage, I wish to continue exploring the various branches and applications of Quantum Field Theory. In particular, I wish to study Supergeometry which has its extensions into Supersymmetry and Superstring Theory. My interests also lie in understanding the Conformal Bootstrap method, Holographic Principle, Quantum Gravity and Black Hole Physics. Recently, I have also explored papers on Open Quantum systems and Entanglement Entropy, how they behave in Conformal field theories.

Together with the wide variety of courses I have taken, and the number of beneficial interactions I have had while being a part of the String group at ICTS, I am confident that I can look forward to an enriching and exciting research or learning opportunity in the summers of 2018 so that I can pursue my desire of studying what I love most.