

Tata Institute of Fundamental Research

Visiting Students Research Programme (2015)

Personal Information

Registration number OVSRP2015-DCMPMS-029566

Name Mr. Atul Singh Arora

Gender male

Date Of Birth 20/11/1991

Place Of Birth New Delhi

Nationality Indian



Permanent Postal Address

4317/3 Ansari Road Darya Ganj 110002

Address For Correspondence

4317/3 Ansari Road Darya Ganj 110002

**Phone No.
(Landline)**

E-mail Address toatularora@gmail.com

Mobile 8699413350

Educational Information

I am studying for Master's degree/Bachelor's degree in Engg Or Tech.

Physics

**Engineering
branch**

Other Degree BS MS **Other Subject**

I would like to be considered for the following department

Areas of study in order of preference

Department Choice : DEPARTMENT OF CONDENSED MATTER PHYSICS & MATERIALS SCIENCE

Area of Research 1 : Nanoelectronics and Quantum Devices

The Write-up

I am interested primarily in theoretical physics. Having learnt about Quantum Field Theory, I have become interested in unification and quantum gravity (even though I haven't had formal courses on the latter two). More recently I have become interested in Quantum Optics, both its theoretical and practical aspects. Other than the fascination with light (and its quanta, the photon), it seems particularly attractive because of its connection with apparently diverse topics such as Quantum Field Theory, fundamentals of Quantum Mechanics and Quantum Computation and Information all of which I have had the privilege of studying in some detail and find interesting in themselves. I am especially interested in Quantum Computation itself. Building a scalable Quantum Computer being the obvious most interesting experimental problem. The more specific area of Quantum Simulation had also been a source of fascination (and sink of effort). I'd even spent a summer exploring Quantum Simulations, together with my colleague which was concluded with verification by an explicit simulation, a method to simulate

Schrodinger's equation with harmonic potential (as was described by a paper), and having independently thought of a way of simulating mixed states, exploiting the superposition principle. Having said that, I'd mention that am not interested in spending too much time writing simulations and doing numerical analysis viz. I prefer to solve problems analytically. I don't have a specific project in mind, but I'd like to work on a topic related to foundations of quantum mechanics. A possible problem is that of quantum measurement and how it's dealt with in the context of fields, or more specifically quantum optics with annihilation operators.

Selected Subject and Degree

Subject PHYSICS

Degree MSC(I)

College/Institution IISER M

Qualifications

Degree	College	University	Year	Class	%Marks	Univ. Rank	Science/Engg. Subjects
SSC	SPV	CBSE	2008	Distinction	93		Science
HSC	SPV	CBSE	2010	Distinction	80		Phy, Chem, Math, Comp Sci
BSC(I)	IISER M	IISER M	2012	Distinction	8.6		Mechanics, Chemistry of elements and chemical transformations, Cellular basis of life, Symmetry, Language Skills B, Introduction to Computers, Physics Lab I, Chem Lab I, Bio Lab I, Electromagnetism, Atoms Molecules and Symmetry, Gene expression and development, Waves and optics, Spectroscopic and other physical methods, Genetics and evolution, Curves and surfaces, Introduction to Astrophysics, Workshop Training, Physics Lab III, Chemistry Lab III, Biology Lab III, Thermodynamics and statistical physics, Energetic
BSC(II)	IISER M	IISER M	2013	Distinction	9.0		Classical Mechanics, Quantum Mechanics, Electrodynamics, Advanced Optics Lab, Reason and Rationality, Statistical Mechanics, Atomic and Molecular Physics, Quantum Computation, Advanced Electronics and Instrumentation Lab, Quantum Field Theory
BSC(III)	IISER M	IISER M	2014	Distinction	9.7	1	Solid State Physics, Nuclear and Particle Physics, Nuclear Physics Lab, Physics of Fluids, Quantum Principles and Quantum Optics, Radiative Effects and Renormalization Group in Relativistic Quantum Field Theory
BE(I)	IISER M	IISER M	2015	Distinction	9.4	1	
BE(II)							
BE(III)							
BE(IV)							
MSC(I)							

When do you expect to complete M.Sc/B.Sc.(Engg)/B.E/B.Tech/M.E/M.Tech/Any other degree(specify)?

I expect to complete my **BS MS** (final) degree in **5/2016**

Publications

Research experience

Summer 2014 Intern, Indian Institute of Science Education and Research, Mohali.

The objective was to devise ways of using a universal quantum computer to perform simulations of quantum phenomena itself, with 'practical' resource requirements. The project involved reading of books and papers, followed by reproducing the results of a paper using a quantum computer simulator, which was written from scratch and an independent discovery of a simple quantum algorithm to simulate mixed states (this result was however already known). I was guided by Prof. Arvind and had helpful discussions with Dr. Sudipta Sarkar and Dr. Abhishek Choudhury. Winter 2013 Intern, Indian Institute of Science Education and Research, Mohali. Studied Mechanics from Landau's first volume (excluding the last chapter) and covered parts of Mathematical Methods from a book on the said topic by Denner and Krzywicki. I was guided by Prof. Jasjeet Bagla and Prof. Sudeshna Sinha. Monsoon 2013 School, National Centre for Biological Sciences, Bangalore. Participated in a Monsoon School on Physics of Life where we treated selected biological phenomena with physical rigour, headed by Dr. Mukun Thattai Summer 2013 Intern,

National Physical Laboratory, New Delhi. Worked on setting up an experiment to study dynamics of a two dimensional magnetic dipole lattice, with Dr. Ravi Mehrotra. Winter 2012 Intern, Indian Institute of Science Education and Research, Mohali. Studied Quantum Mechanics from J.J. Sakurai, under the guidance of Prof. Jasjeet Bagla and created a corresponding report. Summer 2012 Intern, Indian Institute of Science Education and Research, Mohali. Studied Group Theory and Linear Algebra for understanding Symmetry, under Prof. Kapil Hari Paranjape. A brief introductory understanding of the Knot Theory was also undertaken. LaTeX was learnt during this period, to be able to efficiently communicate via the internet. Summer 2011 Intern, Indian Institute of Technology, Bombay. Worked on Image Recognition techniques using OpenCV, for Yarn Fault detection under the supervision of Prof. Anirban Guha. This was an extension to an IIT alumni's Masters thesis. The work was done using Visual Studio, C++ and involved understanding of OpenCV and the idea behind various algorithms, to be able to solve the problem at hand.

Additional academic information

Highest score in Semester V, VI, VII and was given excellence award for the same. Awarded the KVPY fellowship for my work on stepper motor control in 2011

How did you come to know about VSRP?

Friends & Others

Names and addresses of two Referees

Name : H K Bagla
Designation :
Department : Department of Physical Sciences
Institution : IISER Mohali
Address :
E-mail address : hkjassal@iisermohali.ac.in
Telephone number : -
Mobile number :
Report received : No

Name : Sudipta Sarkar
Designation :
Department : Department of Physical Sciences
Institution : IIT Gandhinagar
Address :
E-mail address : sudiptas@iitgn.ac.in
Telephone number : -
Mobile number :
Report received : No