

INTERESTS	Experimental Atomic, Molecular and Optical Physics
EDUCATION	<p>Bachelor of Technology in Engineering Physics with Honors and Minor in Mathematics <i>August 2016 (Expected)</i></p> <p>Indian Institute of Technology - Bombay, India <i>Cumulative Performance Index (CPI) of 9.00 on a scale of 10</i></p>
PUBLICATIONS	<p>Efficient signal processing for time-resolved fluorescence detection of nitrogen-vacancy spins in diamond <i>A. Gupta, L. Hacquebardi and L. Childress (arXiv:1511.04407 [quant-ph])</i> Accepted by Journal of Optical Society of America B and is in press.</p>
TEST SCORES	<ul style="list-style-type: none">• Subject GRE (Physics): 990/990 (Overall 94th Percentile)• General GRE: <i>Quantitative:</i> 167/170, <i>Verbal:</i> 158/170, <i>Writing:</i> 4/6.0• TOEFL: <i>Total:</i> 114/120 (<i>Reading:</i> 30/30, <i>Listening:</i> 30/30, <i>Speaking:</i> 26/30, <i>Writing:</i> 28/30)
TEACHING EXPERIENCE	Served as a teaching assistant for 4 terms for PH 107 ‘Quantum Physics and Applications’ and 2 terms for PH 108 ‘Basics of Electricity and Magnetism’ which are first year introductory courses run by Department of Physics.
RESEARCH EXPERIENCE	<p>Summer Internship: Improving optical readout of NV centers in Diamonds <i>Guide : Prof. Lilian Childress</i> <i>Summer 2015</i> Department of Physics, McGill University, Montreal, Canada [Project Report] I worked on improving the fluorescence optical readout of Nitrogen-Vacancy Centers in Diamond. The standard method of counting photons has been to record the count for a certain time period. This method loses data about time arrival of photon which could have been useful in determining spin state of NV Center more efficiently and probing other properties. I worked on implementing an algorithm to record the photons as fast as electronics allow and analysed the data for spin state detection and estimating various decay rates associated to 3 level and 5 level energy models for NV Center for experimental validity. We have submitted the work to the Journal of Optical Society of America B for publishing.</p> <p>Senior Thesis: Characterization of Charge Carrier properties in Diamond Detectors <i>Guide: Prof. Pradeep Sarin</i> <i>July 2015-ongoing</i> Department of Physics, IIT Bombay, Mumbai, India [Project Report] Diamond detectors have been proposed as the new generation of particle detectors to be used in place of silicon detectors in high energy collision experiments such as at the Large Hadron Collider at CERN. I am working on characterizing the charge carrier properties in these detectors to obtain the parameters which will be useful while developing these detectors for installation at large scales. In phase one of this project, I studied general properties of semiconductor detectors with special emphasis on noise studies and their measurement for using them on the diamond detector in our laboratory.</p> <p>Junior Thesis: Hydrodynamics at Low Reynolds Number and Locomotion of Microorganisms <i>Guide: Prof. Anirban Sain</i> <i>Fall 2014</i> Department of Physics, IIT Bombay [Project Report] Studied hydrodynamic flows at low reynolds number using multipole expansion techniques for action of point forces on fluids. These dynamics resemble the case of microscopic organisms in a fluid. Due to their size, they feel the fluid flow with very Low Reynolds number which dramatically changes the methods used by them to swim in fluid. We studied a model of semi-flexible chain of chemoactive beads for the flagella of microorganisms and their action in fluid.</p>

Summer Internship: Simulated computer model for study of conductivity of Nanowalls of GaN

Summer 2014

Guide: Prof. Subhabrata Dhar

Department of Physics, IIT Bombay

Studied percolation theory and applied it to create a 2-D model for Nanowalls of GaN in order to study their peculiar conducting properties. The simulation assumes Nanowalls as sticks randomly oriented around growing sites whose number depend on filling parameter. Then the conductivity of the network created is calculated to get simulated data for similar experiment. The aim was to fit the experimental data in the results of the simulated model in order to find the conductivity of a single Nanowall which is expected to be much higher than the bulk material.

Very High Energy Gamma Ray Astronomy

Winter 2013 & Summer 2014

Guide: Prof. Kuldeep K. Yadav

[\[Project Report\]](#)

Bhabha Atomic Research Center, Mumbai, India

Studied the basis of ground based very high energy gamma ray astronomy. It involves detection of cherenkov radiation from extensive air shower and subsequent image analysis. I worked on the methods of image cleaning and parametrization using the data from TACTIC gamma ray telescope. Aim of the project was to improve the efficiency of gamma ray detection with more complex image cleaning methods.

Summer internship: Transmission Resonance Energies and Bloch States

Guide: Prof. M.S. Santhanam

Summer 2013

Department of Physics, IISER Pune, India

[\[Project Report\]](#)

The project included study of quantum tunneling phenomenon. Studied a paper on transmission resonances and bloch states in detail and worked out all the derivations and data simulations to bring the conclusions. At the end of the project, studied possible extensions of the project by running further simulations on a spatially perturbed system of the Delta Function Potential array.

KEY COURSE
PROJECTS

Coarsening of Temperature Quenched 2D Ising Model (Course: Advanced Statistical Mechanics)

Fall 2015

Guide: Prof. Dibyendu Das

[\[Project Report\]](#)

Simulated 2D Ising model of a lattice of spin carrying sites and studied their behavior when temperature is suddenly changed. Created videos for such quenching processes when temperature is changed from a high value to zero and half of critical value. Used these simulations to calculate correlation function and domain wall growth verifying Porod's Law.

Smart Solar Water Heater (Electronics Lab Project)

Fall 2014

Guide: Prof. Pradeep Sarin

[\[Project Report\]](#)

Developed a prototype for a smart version of solar water heaters which would provide water at a user-defined temperature and volume by implementing a PID controller using Arduino microcontroller board.

Dynamics of a forced damped non-linear pendulum (Course: Non-Linear Dynamics)

Guide: Prof. Punit Parmananda

Fall 2013

Studied non-linear properties of a forced damped pendulum with simulations and concluded the study with a class presentation.

Electromagnetically Induced Transparency (Course: Photonics)

Guide: Prof. B. P. Singh

Fall 2013

Studied the concept of coherent population trapping and its application in photonics to render a medium transparent in a narrow spectral range by use of a probe laser.

WORKSHOPS

Radio Astronomy Winter School (RAWS-2013)

Dec., 2013

Radio Physics Lab, IUCAA and NCRA, Pune

[\[Presented Poster\]](#)

- Learned basics of radio astronomy via hands-on experiment on construction, initialization and operation of radio telescopes.
- Presented a poster with a team of 4 on 'Cosmic Rays'.
- Worked particularly on H-1 line observation using a 4m Radiotelescope and analysed the data for 5 sources.

Pulsar Observatory for Students (POS-2014)
Radio Astronomy Centre (NCRA-TIFR), Ooty

July, 2013

- The camp involved guest lectures on Pulsar astrophysics and related topics.
- Used Ooty Radio Telescope (ORT) to observe the Pulsar PSR B0628-28 and a quasar to be used as calibrator.
- Ran several analyses on the data collected to find out the time period, Dispersion Measure, flux density and Modulation index of the pulsar.

National Initiative for Undergraduate Students (NIUS 10.1)
Homi Bhabha Center for Science Education, Mumbai, India

Summer 2013
About the camp

- Was among the 60 students selected from all across the country for a nurture program for undergraduate students.
- Attended lectures on topics of front line research in the fields of Astronomy, Astrophysics, Quantum Mechanics and Informatics and Experimental Physics by leading scientists of India.
- Was among the top 30 students selected for projects and subsequent camps.

Vigyan Jyotir Shivir (VIJYOSHI-III)
Indian Institute of Science, Bangalore, India

Winter, 2011
About the camp

The workshop was a science research orientation camp which included guest lecturers from all over the world to explain the current progress of fundamental science research.

KVPY Summer Camp

Indian Institute of Science, Education and Research, Trivandrum, India

Summer, 2011
About the camp

The workshop was a science research orientation camp which included guest lectures by scientists on current research in various fields of Physics, Chemistry, Mathematics and Biology. The camp also included laboratory visits to prominent research institutes in Trivandrum, India.

**SCHOLASTIC
 ACHIEVEMENTS**

- I am **ranked 3rd** (top 10 %) in my batch at the Department of Physics, IIT-Bombay.
- Secured **All India Rank 128** in AIEEE 2012 with 99.99 percentile among ~1.2 million students.
- Secured **All India Rank 1309** in IIT-JEE 2012 with 99.73 percentile among ~0.5 million students.
- Secured the **KVPY** (Kishore Vaigynaik Protsahan Yojana) fellowship awarded by the Govt. of India which, competitively based on a comprehensive examination and a technical interview, to promising students of the physical sciences.
- Awarded the **NTSE** (National Talent Search Examination) fellowship by National Council of Educational Research & Training through an examination selecting top 1000 students in the country.
- Secured certificate of merit for being in the national **top 1%** in National standard examination in Physics (**NSEP**), organized by HBCSE.

TECHNICAL SKILLS

- **Programming:** C/C++
- **Operating Systems:** Linux (Ubuntu), Windows
- **Analysis Tools:** Root, MATLAB, Mathematica, GNU PLOT, MS Office
- **Typesetting and markup languages:** L^AT_EX, HTML

RELEVANT COURSES

Advanced Physics Courses:

Relativistic Quantum Mechanics, Quantum Computation and Information Processing, Adv. Statistical Mechanics, General Relativity, Group Theoretical Methods, Experimental Nuclear Particle Physics, Photonics, Non-Linear Dynamics

Other Physics Courses:

Atomic & Molecular Physics, Condensed Matter Physics, Quantum Mechanics I & II, Nuclear & Particle Physics, Statistical Physics, Wave & Thermodynamics, Analytical Physics Methods, Classical Mechanics, Continuum & Fluid Mechanics, Optics

Mathematics & Electrical Engineering:

Linear Algebra, Differential Equations, Real Analysis, Complex Analysis, Fourier Transform and Analysis, General Topology, Group & Ring Theory, Data Analysis & Interpretation, Ordinary & Partial Differential Equations, Numerical Analysis, Analog & Digital Electronics, Microprocessors Lab

Positions of Responsibility

- **General Secretary of Physics Department** *[April 2015-present]*
Currently heading the student council which represents undergraduate and masters student of the Physics Department, IIT Bombay.
- **Manager of Maths and Physics Club, IIT Bombay** *[2014-15]*
A student body which organizes talks, group discussions, screenings, lab tours and meetings for spreading awareness about mathematics and physics. [Annual Report](#)
- Received **Organizational Color** for technical activities for above position. This award is given by Students' Gymkhana Body for carrying out a position of responsibility efficiently and creating awareness and bringing new ideas in the field.

Technical Activities

- **Solar Decathlon 2014, team member of phase one** *[Winter,2012]*
An International competition in which teams have to build a completely energy self-sufficient portable house using Solar Energy as its sole source of energy. Worked with the team representing India for the first time. [Proposal Report](#)
- **Energy Technologies Vision 2035** *[Fall,2012]*
A student initiative which ran parallel to the 'Vision 2035' project of the Government of India. Our aim was to survey the youth population studying in science and engineering colleges to get their views about energy needs and generation plans which India should think upon according to scenarios in 2035. We also promoted the ideas thus collected through talks and group discussions. Finally we submitted a [report](#) to the Government of India for consideration while planning energy policies.
- **ASME selection trials** Made a remote controlled robot capable of picking up object and placing them at specified positions. *[2013]*
- **XLR8 2** Made a robot capable of playing foosball for an institute-wide competition. Got a special mention for the innovative idea. *[2013]*
- **Line Follower** Made a line following robot for an institute wide competition. *[2012]*
- **XLR8 1** Made a wireless robot capable of completing the specified track for an institute wide competition. *[2012]*

Others

- **Second runner up** in the conceptual science quiz 'Mimamsa' organized by IISER Pune. *[2014]*
- **Institute Basketball League 2013** Played for the winning team. *[2012]*

REFERENCES

- **Prof. Lilian Childress** (Summer Internship Guide) childres@physics.mcgill.ca
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Webpage - <http://childressgroup.blogspot.in/p/home.html>
 - **Prof. Pradeep Sarin** (Senior Thesis Guide) pradeepsarin@iitb.ac.in
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