Sandesh Kalantre

IIT Bombay

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Education

2014-2018	**B.Tech in Engineering Physics**, *Indian Institute of Technology, Bombay*, **CPI - 9.81/10**. Pursuing a minor in **Computer Science** and Honours in **Physics**
2012-2014	**Intermediate/+2**, *S. P. College*, Pune, Percenatge – 94.31. Ranked 1st in the college among 800 students
2012	**Matriculation**, *Dyanmata High School*, Amravati, Percentage – 97.82.

Academic Achievements

2015	Ranked **2nd** in the Department and overall **10th** in the Institute (in a batch of 880)
Sept 2011	**Gold Medal** at the 16th International Astronomy Olympiad, Almaty, **Kazakhstan** and **ranked 1st among participants from 21 countries**
Aug 2012	**Gold Medal** at the 6th International Olympiad on Astronomy and Astrophysics, Rio de Janerio, **Brazil** and ranked 18th among participants from 28 countries
Aug 2013	**Silver Medal** at the 7th International Olympiad on Astronomy and Astrophysics, Volos, **Greece**
2014	**All India Rank 335**, IIT-JEE among *1.36 million* participants for entrance to the IITs.
2013	**Gold Medal** and Certificate of Merit in **Indian National Physics Olympiad (2013)** for being among national top 35 out of ≈ 10000 students
2014	Awarded an **AP** grade (given only to top 1%) for exceptional performance in Quantum Physics and Application, Complex Analysis, Computer Programming, Physical Chemistry and Introduction to Electronics at IIT Bombay
2015	**Institute Academic Award (2014-2015)**, IIT Bombay
2009-2010	**All India Rank 4** in 4th International Mathematics Olympiad and 12*th* National Science Olympiad

Scholarships

2013	Kishore Vigyan Protsahan Yojana(**KVPY**) awarded by Department of Science and Technology, India for promotion of basic sciences among high school students to ≈ 250 students in the country
2010	National Talent Search Scholarship(**NTSE**) awarded by the National Council for Educational Research and Training to ≈ 1000 students in the country
2011-2013	Infosys Award for International Olympiad medalists by HBCSE in association with the Infosys Foundation and TIFR Endowment Fund

2012   Amul Vidya Shree Award for excelling in Secondary School Certificate(SSC) Examination, 2012

Experience: Quantum Computation and Computer Science

August   **Quantum Teleportation with NV Centres**,
2015   *Prof. Bhaskaran Muralidharan, Department of Electrical Engineering, IIT Bombay.*

- Investigated a photonic channel mediated method to generate heralded entanglement between two distant($\sim 3m$) NV electron spins
- Studied the use of **indirect** Bell measurements of NV electronic spin and N nuclear spin to accomplish teleportation of quantum states
- Working on designing a simulation to reproduce the teleportation scheme

June   **Quantum Algorithms and Information**,
2015   *Prof. P. K. Panigrahi, Department of Physics, IISER Kolkata.*

- Examined the canonical quantum algorithms - Deutsch-Josza, Shor & Grover and studied their computational complexities
- Applied Grover's Search algorithm to search for the existence of an Eulerian circuit in a undirected graph given the adjacency list representation
- This project was supported under the National Initiative on Undergraduate Science (NIUS) Programme in Physics which is awarded to **top 20 students in the country**.

Autumn   **NumCpp - arbitary precision mathematical library in C++**,
2014   *Prof. D. B. Pathak, Department of Computer Science and Engineering, IIT Bombay.*

- Wrote a stack based parser using Djitstra's shunting yard algorithm to parse function definitions as well as mathematical equations
- Implemented routines for numerical integration, numerical differentiation and root finding of a function in a given interval.
- Wrote procedures for matrix operations and finding the Fast Fourier Transform(FFT) of an array of complex numbers

Experience: Astronomy and Astrophysics

August   **Pair-production anomaly from propagation of VHE gamma-rays**,
2015   *Prof. V. Rentala, Department of Physics, IIT Bombay.*

- Investigated various components of Extra-galactic Background Light (EBL) at μm wavelengths and their relative contributions to the pair production process
- Explored a model of the optical depth for gamma-ray sources using EBL models and simulated the presence of a spectral-break in GeV and TeV spectra
- Working on Inter-Halo Light (light from stars outside galaxies) models to scrutinize its effect on VHE spectral indices and the spectral-break

December   **Pulsar Observatory for Students (POS) - 2014**,
2014   *K. Krishnakumar, Radio Astronomy Centre, Ooty - NCRA-TIFR.*

- Studied the operation of the Ooty Radio Telescope (ORT),a 530-metre (1,740 ft) long and 30-metre (98 ft) wide Cylindrical Paraboloid telescope.
- Collected raw time-series data for pulsars using the ORT and analysed using Numpy/Scipy
- The processed data was used to explore various properties such as the Dispersion Measure(DM), modulation index and pulse broading due to interstellar scattering for various pulsars.
- The slides of the final presentation are available at
  http://home.iitb.ac.in/~sandeshkalantre/presentations/sandesh_pos2014.pdf

Positions of Responsibility

Autumn 2015 **Teaching Assistant**,
PH107 - Quantum Physics and Application, IIT Bombay.

○ Mentoring a batch of around 50 students in the course content
○ Involved in evaluation of exams and quizzes

May 2015 **Resource Person**,
Indian Astronomy Olympiad Programme, HBCSE - TIFR, Mumbai.

○ Involved in generation of problems for selection of the Indian Team to the International Olympiad on Astronomy and Astrophysics (IOAA)
○ The team was awarded **3 Gold & 2 Silver medals** in the International Olympiad on Astronomy and Astrophysics(IOAA), Indonesia, 2015, which was India's best result in 9 years.

July 2015 **IPho-rum**,
Browser Application for International Physics Olympiad, 2015, Mumbai.

○ Worked in a team of 2 in development of IPhorum - a browser based application for tasks such as voting, translation upload and feedback submission among *approx* 100 users
○ Used *Node.js* as the server application and Mongodb as the primary database

2015-2016 **Convener**,
Maths and Physics Club, IIT Bombay.

○ Organisation of events fostering to the enthusiasm of students in Physics and Mathematics catering to around **400-500** students on campus and having an outreach of around **4000** online
○ Worked on designing a **Homopolar Motor** for demonstration to freshmen

Computer skills

Programming C, C++, Fortran, Python, Haskell, HTML, CSS, Javascript, Perl, bash

Science Packages NumPy, SciPy, Matplotlib, QuTip, Astropy, gnuplot, Octave, SPICE Circuit Simulation, GNU GMP/MPFR library

Softwares LaTeX, Git, InkScape, AutoCad, Pelican, Node.js, Wireshark

Key Courses

Physics Classical Mechanics*, Special Relativity, Non-Linear Dynamics*, Quantum Physics and Applications, Electricity and Magnetism, Physics lab

Mathematics Complex Analysis, Differential Equations*, Linear Algebra

Others Computer Networks*, Electronics, Computer Programming and Utilization

(* courses are will be completed by end of Autumn 2015)

Extra-curricular activities

○ Interested in abstract mathematics, teaching, literature, history and mythology
○ Built a Kelvin Water Dropper and demonstrated build-up of a potential difference under Maths and Physics club, IIT Bombay.
○ Secured 2nd positon in the Bazinga Physics Quiz organised by Maths and Physics club, IIT Bombay.
○ Associated with National Service Scheme, IIT Bombay under Educational Outreach program.
○ Secured first prize in Debate competition held at Dynamata High School, Maharashtra.
○ Secured first place in Inter-School Geography Quiz.