Sandesh Kalantre

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Education

2014-2018 **Sophomore Undergraduate, B.Tech in Engineering Physics**, *Indian Institute of Technology, Bombay*, **CPI - 9.88/10**.
Minor in Computer Science and Honours in Physics

2012-2014 **Intermediate/+2**, *S. P. College*, Pune, Percenatge – 94.31.
Ranked 1^{st} *in the college among 800 students*

2012 **Matriculation**, *Dyanmata High School*, Amravati, Percentage – 97.82.

Academic Achievements

2015 Ranked $1^{st}/42$ in the Physics Department and among the top 10 in the institute (batch of 880).

Sept 2011 **Gold Medal**, 16^{th} *International Astronomy Olympiad*.
Kazakhastan, ranked 1^{st} among participants from 21 countries

Aug 2012 **Gold Medal**, 6^{th} *International Olympiad on Astronomy and Astrophysics*.
Brazil, International Rank 18th

Aug 2013 **Silver Medal**, 7^{th} *International Olympiad on Astronomy and Astrophysics*.
Greece

2014 **All India Rank 335**, IIT-JEE among *121,000* overall 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* $\approx$ *10000 students*

2014 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 for being among the top 10 students on the basis of CPI

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 $\approx$ 250 students in the country

2011-2013 Infosys Award for International Olympiad medalists by HBCSE in association with the Infosys Foundation and TIFR Endowment Fund

2010 National Talent Search Scholarship (**NTSE**) awarded by the National Council for Educational Research and Training to $\approx$ 1000 students in the country

Experience

Present **Quantum Entanglement and Teleportation**,
Prof. B. 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
- Worked on the interpretation of *von-Neumann entropy* in entangled quantum systems
- Studied the properties of the *spin exchange Hamiltonian* among electronic spins and nuclear spin baths.

June 2015 **Quantum Algorithms and Information**,
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 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 2015 **Metapopulation models and Coupled Logistic Maps**,
Course Project - Non-Linear Dynamics, IIT Bombay.

- Studied coupled logistic maps as a model for metapopulation dynamics
- Worked on the calculation of *Lyapunov exponents* from the time-series analysis
- Studied *Taken's Embedding Theorem* and worked on attractor reconstruction for the model system

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

- Investigated various components of Extra-galactic Background Light (EBL) at μm wavelengths
- 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 2014 **Pulsar Observatory for Students (POS) - 2014**,
K. Krishnakumar, Radio Astronomy Centre, Ooty - NCRA-TIFR.

- 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, Modulation Index and Pulse Broadening due to interstellar scattering

Autumn 2014 **NumCpp - arbitary precision mathematical library in C++**,
Prof. D. B. Pathak, Department of Computer Science, 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 FFT, numerical integration and differentiation, root finding of a function with arbitrary precision support using the GNU MPFR Library

Positions of Responsibility

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

- Mentored 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
- The team was awarded **3 Gold & 2 Silver medals** in the International Olympiad on Astronomy and Astrophysics, Indonesia, 2015, which was India's best result in 9 years.

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

- Worked in a team of 2 in development of IPho-rum — 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++, 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	Quantum Mechanics I*, Classical Mechanics, Special Relativity, Non-Linear Dynamics, Digital Electronics Lab*, Electricity and Magnetism
Mathematics	Numerical Analysis*, Complex Analysis, Differential Equations, Linear Algebra
Others	Data Structures and Algorithms*, Signals and Systems*, Computer Networks

(* courses are will be completed by end of Spring 2016.)

Extra-curricular activities

- Interested in abstract mathematics, teaching, literature, history and mythology
- Gave a talk on *Chaos in Celestial Mechanics* for Kritika, Astronomy Club of IIT Bombay
- Built a Kelvin Water Dropper and demonstrated build-up of a potential difference
- Secured 2^{nd} positon in the Bazinga Physics Quiz organised at 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.