

Amey P Gaikwad

Senior Undergraduate - B.Tech(Hons.) with Minors in Mathematics,
Engineering Physics ,
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Examination	University	Institute	Year	CPI/%
Graduation	IIT Bombay	IIT Bombay	2019	9.69
Intermediate/+2	Mumbai University	Pace Junior Science College, Nerul	2015	94.9
Matriculation	ICSE, Delhi	Ryan International School, Kharghar	2013	96.7

FIELDS OF INTEREST

- Quantum field theory, Conformal Bootstrap, String Theory, Holography, Theoretical Condensed Matter Physics, Black Hole Physics

TECHNICAL SKILLS

- **Languages** : C++, Java, Python, VHDL
- **Tools** : Mathematica, \LaTeX , OriginPro, MATLAB, Gravipy, Numpy, Scipy, Arduino, FPGA
- **Key Courses**: Special and General Relativity, Classical and Quantum Mechanics, General Topology, Complex Analysis, Group theory Methods in Physics , Relativistic Quantum mechanics and Quantum Field Theory, Elementary Particle Physics, Theoretical Condensed Matter Physics, Solid State physics Statistical Physics
- **Extra Courses**: Courses taken at other places:
 - **String Theory** - Ongoing - Dr. Shiraz Minwalla, Tata Institute of Fundamental Research.
 - **Black Holes and Entanglement** - June 2018 - Prof. Timothy Hollowood, Swansea University.

RESEARCH PROJECTS

- **Conformal Bootstrap** (Bachelors Thesis - Research Project)
(Guide: Dr. Shiraz Minwalla (TIFR - Department of Theoretical Physics) Spring 2018 - Ongoing)
 - The conformal Bootstrap philosophy - Ising model as an illustration
 - Simon Caron-Huot's Lorentzian OPE inversion formula.
- **Quantum Complexity in Quantum Field theory - implications in Holography** (Research Project)
(Guide: Prof. S. Prem Kumar (University of Swansea : Particle Physics and Cosmology Theory Group) Summer 2018 - Ongoing)
 - Adopt the definition of circuit complexity to define quantum complexity. Calculate the complexity for quantum field theories in de-sitter spacetimes.
 - Calculate the quantum complexity for the topological AdS crunch models and for the scalar sector of N=4 SYM theory.
 - Report: <https://github.com/ameypg16/Reports/blob/master/Quantum-Complexity.pdf>
- **Quantum Field Theory** (EP 322 Supervised Learning Project)
(Guide: Dr. R. Loganayagam (ICTS-TIFR - String Group) and Coguide: P. Ramadevi (Department of Physics , IITB) , Autumn 2017-2018)
 - Path Integral Formulation of Quantum Mechanics, Zero and one dimensional quantum field theory.
 - Schwinger Dyson equation, Perturbation Theory, Symmetry factors and Feynmann Diagrams.
 - Scattering matrix through the path integral formalism.
 - Basics of Grassmanian algebra, and representation of Lorentz group.

- Report: <https://github.com/ameypg16/Reports/blob/master/SLP-QFT-Report.pdf>
- **Instantons, Monopoles and Solitons in Non Abelian Gauge theories** (ICTS SN Bhatt Memorial Excellence Fellowship Program)
(Guide: Dr. Pallab Basu (ICTS-TIFR - String Group) , Summer 2017)
 - Confinement: Instantons, solitons and monopoles in Non Abelian gauge theories.
 - Instantons of the double well potential and in the Yang-Mills theory.
 - Symmetry breaking (Goldstone theorem) and Higgs mechanism.
 - Polykov monopole and the BPST monopole via the Bogomol'nyi bound.
 - Report: <https://github.com/ameypg16/Reports/blob/master/Amey-Report-SNBhatt.pdf>.
- **Multistability of planar bistable liquid crystals** (National Program on Differential Equations(NPDE))
(Guide: Prof. Neela Nataraj (HOD: Department of Mathematics,IITB) , Winter 2016)
 - Finite Elements Method and the Newton Galerkin approximation to analyse what drives the normal bistable liquid crystals into multistability.
 - Analysis done using the Landau de Gennes free energy framework for the liquid crystals.
 - Report: <https://github.com/ameypg16/Reports/blob/master/NPDE-report.pdf>
 - Code files: <https://github.com/ameypg16/NPDE-Final-D1>.

COURSE PROJECTS

- **Anyons via the path integral approach** (PH 522 Theoretical Condensed Matter Physics)
(Prof. Soumya Bera (Department of Physics, IITB), Spring 2017-18)
 - Studied the concept of anyons through the path integral approach. Only Abelian anyons were studied.
 - Studied the Physical model of the anyon and showed the spin statistics for a two anyon system.
 - Very briefly touched upon the toric model.
- **Power of a Carnot Engine** (EP320 Statistical Physics)
(Prof. Sumiran Pujari (Department of Physics, IITB), Spring 2017-18)
 - Studied the reasons why the Carnot engine efficiency is unattainable
 - Studied the reasons other than the real world losses that lead to the decrease in the Carnot efficiency in real world
 - Studied the ways to maximise the power of a Carnot engine and relate the theoretical efficiency at maximum power obtained with the practically obtained efficiency.
- **2D Mapping using Ultrasonics** (EP 315 Electronics Lab - Microprocessors)
(Prof. Pradip Sarin (Department of Physics, IITB), Autumn 2017-18)
 - Used Arduino microprocessor and ultrasonics to map out the 2D topological features.
 - The 2D map was plotted on the monitor.
 - Report:<https://github.com/ameypg16/Reports/blob/master/Microprocessors-Report.pdf>
- **Music Synthesis** (EP 226 - Waves,Oscillations and Optics)
(Guide: Prof. Tapanendu Kundu (Department of Physics,IITB) , Spring 2016-17)
 - Developed a code to tailor a song from the bare essentials - the frequency of the notes/chords involved and the duration.
 - Appropriate ADSRs were chosen depending on the instrument and the scenario being mimicked.
 - Report:<https://github.com/ameypg16/Reports/blob/master/music-synthesis-report.pdf>
- **3 Body Collider Simulation** (EP 230 Electronics Lab - Digital Systems)
(Guide: Prof. Pradip Sarin (Department of Physics,IITB) , Spring 2016-17)
 - Developed a code in VHDL using an FPGA board to simulate an animation involving 3 bodies.
 - The bodies were coded to bounce off each other and off the walls delimited by the VGA monitor.
 - Project Report : https://github.com/ameypg16/Reports/blob/master/FPGA_project_3_body_collision.pdf
- **Chaos in Cryptography** (PH 542 Non Linear Dynamics)
(Guide: Prof. Amitabha Nandi (Department of Physics,IITB) , Autumn 2016-17)
 - Analyzed the topological similarities between cryptography and chaos theory and how chaos can be used in cryptography.

- Used the Baptista algorithm and chaotic maps were developed on the basis of the logistic map and Lorenz's dynamical model.
- Project Presentation: <https://github.com/ameypg16/Reports/blob/master/NLDproject.pdf>

ACADEMIC ACHIEVEMENTS

- Ranked **second in the institute among a batch of 900 students** for the academic years 2015 - 2018.
- Ranked **first** in the Physics Department in the academic year 2015-2017.
- **Ranked second in the Physics Department** for the academic years 2017-18.
- **Awarded the Institute Academic Award** by IIT Bombay for the year 2015-16 (**3rd in the Institute** - CPI-9.94)
- Secured an **SPI of 10.0** in the first semester 2015-16.
- Awarded **AP** grade (awarded to the top 1% of the class) for Calculus and Numerical Analysis.
- **2015** : Topper in Maharashtra Board in **Physics** (100/100) and **Electrical Maintenance** (200/200)
- **2014-15** : **National Top 1% in NSEP** (Physics).
- **2014-15** : **National Top 1% in NSEA** (Astronomy).
- **2015** : Offered admission to the **Chennai Mathematical Institute (CMI)**, **Indian Statistical Institute (ISI)**, and the **Indian Institute of Science (IISc)**.

MENTORING EXPERIENCE

- **Department Academic Volunteering Program (DAVP)**: Appointed as a tutor for the Physics Department for the academic year **2018-19**. Mentor to sophomores and third year students to help them with their courses in quantum mechanics and relativity.
- **Summer Of Science Mentor**: As a part of the Maths and Physics Club organized Summer of Science Program, appointed as a mentor to three students interested in learning the topics: Special and General Relativity, Field Theory, Electrodynamics, Topology and Particle Physics during the summer of 2018.

RESEARCH PRESENTATIONS

- **Quantum Complexity**: Research project - Swansea University, (July 2018).
- **Instantons and Monopoles**: SN Bhatt Fellowship - International Centre for Theoretical Sciences, (July 2017)
- **Zero Dimensional Quantum Field Theory and Feynman Diagrams** : Supervised Learning Project - Indian Institute of Technology, Bombay (November 2017)

SCHOLARSHIPS

- **2015** : Awarded eligibility for **INSPIRE Scholarship** (by qualifying within top 1% of Maharashtra board at class XII – March 2015)
- **2013** : Kishore Vigyan Protsahan Yojana (**KVPY**) awarded by Department of Science and Technology, India for promotion of basic sciences among high school students.
- **2011-2012** : National Talent Search Scholarship **NTSE** awarded by the National Council for Educational Research and Training.

RESUME AND REPORTS

- Resume : <https://github.com/ameypg16/CV>
- Reports : <https://github.com/ameypg16/Reports>