



**Amey Prashant Gaikwad**  
**Engineering Physics**  
**Indian Institute of Technology Bombay**

**15D260002**  
**UG Third Year (B.Tech.)**  
**Male**  
**DOB: 21/10/1997**

Examination	University	Institute	Year	CPI / %
Graduation	IIT Bombay	IIT Bombay	2018	9.78
Intermediate/+2	MUMBAI UNIVERSITY	PACE JUNIOR SCIENCE COLLEGE , NERUL	2015	94.92
Matriculation	ICSE, Delhi	RYAN INTERNATIONAL SCHOOL , KHARGHAR	2013	96.70

#### 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,  $\text{\LaTeX}$ , OriginPro, MATLAB, Gravitpy, Numpy, Scipy, Arduino, FPGA
- **Key Courses**: Special and General Relativity, Classical and Quantum Mechanics, General Topology, Differential equations, Real, Complex and Numerical Analysis, Basic Algebra , Group theory Methods in Physics , Relativistic Quantum mechanics and Quantum Field Theory, Elementary Particle Physics (Ongoing), Theoretical Condensed Matter Physics(Ongoing), Condensed Matter Physics (Ongoing), Statistical Physics(Ongoing)

#### RESEARCH PROJECTS

- **Large N Conformal quantum mechanics in the context of Holography** (Research Project)  
(Guide: Prof. S. Prem Kumar (University of Swansea : Particle Physics and Cosmology Theory Group) Summer 2018 - Upcoming)
  - Project details and topic not decided yet.
- **Conformal Bootstrap** (Research Project)  
(Guide: Dr. Shiraz Minwalla (TIFR - Department of Theoretical Physics)Spring 2018 - Ongoing)
  - Conformal Invariance, Radial Quantization, Conformal Block expansion
  - Bootstrap Philosophy, Introduction to the 3D Ising CFT
- **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

- **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.
- **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.
- **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](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.
- **Topper in the Physics Department** for the academic years 2015-18.

- Ranked **first** in the Physics Department in the academic year 2015-2016.
- **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 Mentorship Program (DAMP)**: Appointed as a mentor for the Physics Department for the academic year **2018-19**. Mentor to sophomores and third year students to help them to know what the department offers them - different research avenues, professors, extra courses, administration, etc.
- **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

- **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>