

# CURRICULUM VITAE

ANIRBIT

## 1. BIO-DATA

Name	Anirbit Mukherjee
Date of birth	February 28 , 1987
Sex	Male
Current occupation	Student (B.Sc. Physics 3rd Year)
Course	B.Sc. (Hons) Physics
Expected date of completion	July 2008
Institution	Chennai Mathematical Institute Chennai, India , <a href="http://www.cmi.ac.in">http://www.cmi.ac.in</a>

## 2. CONTACT INFORMATION

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## 3. ACADEMIC ACHIEVEMENTS

3 of my best academic achievements have been the following :

- (1) During the first year of my undergraduate studies at CMI Chennai Mathematical Institute I was selected as a *Transfer Student* to the Physics department of **California Institute of Technology (Caltech) ,Pasadena , USA** via an internationally conducted written subjective test in Physics and Mathematics.
- (2) Out of the all the students in the Physics Department of CMI , I was invited to deliver a seminar on lagrangian approach to electrodynamics in May 2007 at **IGCAR (Indira Gandhi Centre for Atomic Research ) , Kalpakkam** by Dr.Subramanian He is a faculty at IGCAR .Other than me the other speakers at this forum have all been faculty members and scientists.Part of my seminar transcript can be viewed at <http://www.cmi.ac.in/~anirbit/actionfunction.pdf>
- (3) During July 2007 I was personally selected by Prof.Shiraz Minwalla to do a summer program under his guidance in field theory at **TIFR (Tata Institute Fundamental Research , India)** . Being the only undergraduate student selected for the camp , I was the youngest student that year for the Physics program.

## 4. SCHOLARSHIPS RECEIVED

The major scholarships I have been awarded are :

- (1) I was selected for the **KVPY (Kishore Vaigyanik Protsahan Yojna)** scholarship among 42 students across India.I have been in receipt of this scholarship awarded by **Department of Science and Technology , India** since 2003.
- (2) I was selected for the **Undergraduate Associateship** by the **Saha Institute of Nuclear Science (SINP) ,India** in 2006 among 15 other students across India.
- (3) Based upon my academic performance **CMI (Chennai Mathematical Institute)** has completely waived my tuition fees and I have also been awarded a monthly stipend.

## 5. HIGH SCHOOL ACHIEVEMENTS

- (1) I secured **All India Rank** of 35 in the 4<sup>th</sup> **National Science Olympiad** and 70<sup>th</sup> in the 5<sup>th</sup> N.S.O
- (2) During my high-school I was placed among the top 1% of the 22000 candidates across India who gave the **National Standard Examination in Physics (NSEP)**.
- (3) I was ranked **First** in the Physics Entrance Test of **Presidency College , Kolkata** and **Fourth** in the Mathematics Entrance Test for the same college.
- (4) I was selected for the **B.Stat.** program of **I.S.I (Indian Statistical Institute )**

## 6. 3 SUMMER PROGRAMS THAT I HAVE UNDERTAKEN

**6.1. Under Prof.Shiraz Minwalla in July 2007 ( Solitons and Gauge Invariance ).** During this camp I studied the 2 lectures of **Sidney Coleman** from from **Aspects of Symmetry** as listed in the SOP. I was thrilled at the interplay of homotopy theory in the process of classifying **Soliton** solutions. I studied this aspect (*Topological Conservation laws* ) in the special cases like the *Georgi-Glashow* and the *Weinberg-Salam* model.

During that camp I parallely studied the basics of *non-Abelian gauge fields* from **Quantum Theory of Fields-II** by S.Weinberg and studied how *Noether's theorem* gives rises to conserved currents like that of *Stress-energy tensor*. I computed the *Higgs Mechanism* and the phenomenon of *Goldstone Bosons* in some special cases.

**6.2. Under Prof.M.S.Raghunathan (F.R.S) in July 2007 ( Geometry of Fibre Bundles ).** While in TIFR ,from Prof.M.S.Raghunathan (F.R.S),I gained intricate insights into the concept of *metric compatibility* and *torsion free* properties of connections,vector bundle valued differential forms and *connections on Principle Bundles* and Hopf degree.I studied the lectures of Koszul for most of the topics.

**6.3. Under Prof.G.Rajshekharan in May 2006 ( The Dirac Equation ).** During this summer vacation at the end of my first year I studied the Dirac Equation under the guidance of Prof.G.Rajshekharan. During this period I studied the first 14 lectures of the course titled **Interaction of light and Matter-Quantum Electrodynamics** that Feynman delivered in 1961 to the graduate class at California Institute of Technology.I also studied some parts of the book "Advanced Quantum Mechanics" by Sakurai

## 7. 3 READING COURSES THAT I HAVE UNDERTAKEN

**7.1. Under Prof.G.Rajshekharan during Feb-April 2006 (General Relativity).** During Feb-April 2006 under the guidance of Prof.G.Rajshekharan I studied the basic formal aspects gained clear understanding of the fundamental concepts on which General Relativity rests.

During this endeavour I mainly studied the sections on General Relativity from the book **Theory of Classical Fields** by Landau and Lifshitz.

**7.2. Under Prof.Ramanan since Dec 2006 (Differential Geometry and Algebraic Topology ).** I have been studying under the tutelage of Prof.Ramanan since December 2006.

I have studied advanced mathematical concepts like point set topology ,differential geometry,theory of differential forms ,homotopy theory and sheaf theory from the relevant sections of the book **Global Calculus** authored by him. I am currently learning theory of **Homology** and **Cohomology** from him which he is teaching from the point of view of **Category Theory**.I have been studying these topics from the book **Algebraic Topology** by Allen Hatcher.

Through sessions with Prof.Ramanan I have gained understanding of the concepts of vector bundles and connections.I was thrilled to see how differential geometry can be seen in a more enriching perspective in the language of *Sheafs* and *Germes* and grand generalizations of the concept of *pull-backs* of a vector bundle could be seen through "fiber product of sheafs".

7.3. **Under Prof.R.Parthasarathy since Aug 2007 (Quantum Field Theory).** I have been studying Quantum Field Theory from the book **Quantum Theory of Fields-I** by **Steven Weinberg** since my 4<sup>th</sup> semester of undergraduate studies. From August 2007 I started formalizing my earlier studies and learning more of QFT from Prof.R.Parthasarathy.

During this endeavour I am studying mainly from the lecture notes of **Prof.Sidney Coleman** of the QFT course that he had delivered at Harvard University. I am also studying from the book by Peskin and Schroeder.

## 8. STUDENT SEMINARS I HAVE DELIVERED

The topics of the major student seminars that I have delivered in CMI are as follows :

*Transcripts for most of my seminars can be viewed at [www.cmi.ac.in/anirbit/seminars](http://www.cmi.ac.in/anirbit/seminars)*

- (1) A seminar on translating The Theory of Special Relativity in terms of the **Poincare Group** and elucidating the algebraic properties of the Poincare Group.
- (2) A seminar on calculating the **Fundamental Group**  $\pi_1$  of the Poincare Group and then how from that one can motivate the **Quantum Superselection Rule**
- (3) A seminar on the construction of the **Heegard Decomposition** of  $S^3$  and the construction of the **Hopf Map** and **Hopf Fibration**.
- (4) A seminar on generalizing the **Hopf Map** to higher dimensional spaces using **Quaternions** and then on understanding the general structure of the maps between projective spaces and higher dimensional spaces.
- (5) **2 seminars on Vector Potentials and Gauges** where I discussed the following aspects :
  - Dirac String and Dirac monopole quantization.
  - Aharonov-Bohm effect
  - Flux quantization in a superconductor.
  - Requirement of  $\pi_2$  of the space to be trivial for a vector potential to be defined.
  - Choosing gauges covariantly to ensure relativistically invariant orthogonality of electric and magnetic fields.

## 9. MY SCORES AT CERTIFYING EXAMINATIONS

9.1. **Terminology. CGPA** (Cumulative Grade Point Average) is the average of the grade points (out of maximum of 10) that I have been awarded in the courses in all the 3 broad classes of courses : **Physics , Mathematics and Humanities**. My grades in the courses which were NOT added to my CGPA and non-graded courses are given separately.

**Optional** courses are marked by a \* and the **Graduate** courses I have attended are marked by a \*\*.

9.2. **Overview.** I am currently in the 3<sup>rd</sup> (Final) year of the **Bachelor of Science (Honours) , BSc.(Hons.)** in Physics at the **Chennai Mathematical Institute , CMI , India** . Given below are my scores at the major certifying examinations :

Level	Year of completion	Score
Class 10 (secondary)	2003	93%
Class 12 (senior secondary)	2005	94.75%
Average GPA in the Physics courses during B.Sc. (first 4 semesters)		9.3/10
CGPA during BSc. (first 4 semesters )		8.89/10

- The important marks in the Class 10 exam were : 94% in Science ,92% in Mathematics and 92% in Computer Science.
- The important marks in the Class 12 exam were : 98% in Mathematics ,97% in Chemistry ,92% in Physics and 90% in Computer Science.

9.3. **Courses which are NOT added to my CGPA.** The following are the 3 courses which have not been added to my CGPA

Course	Instructor	Grade Point out of 10
Fourth and Fifth semester		
<b>Riemannian Geometry</b> **	Prof.M.Vemuri	10
<b>General Relativity</b> **	Prof.G.Date	(not-yet graded)
<b>Superfluidity and Superconductivity</b> **	Prof.G.Baskaran	(non-grading)

9.4. **Graded courses added to my CGPA.** In Chennai Mathematical Institute, a grade point is awarded in each subject out of 10. A grade of *A* corresponds to 10 out of 10, a grade of *AB* corresponds to 9 out of 10, while a grade of *B* corresponds to 8 out of 10 and a grade of *BC* corresponds to 7 out of 10.

List of courses whose grades were added to my CGPA, with instructor's name and grades:

Course	Instructor	Grade Point out of 10
First semester		
Calculus I	Prof.T.Parthasarathy	10
Classical Mechanics	Prof.P.P. Divakaran	9
Programming I (Haskell)	Madhavan Mukund	9
Algebra I	Prof.V.Balaji	7
English	Prof.Shreekumar Varma	7
Second semester		
Electromagnetic Theory I	Prof.K.S.Balaji	10
Calculus-II	Post-Doctoral students from E.N.S (Paris)	9
Classical Mechanics-II	Prof.M.V.N Murthy	9
Economics	Prof.Shanthi	9
Statistical Physics I	Prof.K.P.N Murthy	9
Third semester		
Quantum Mechanics I	Prof.R.Parthasarathy	10
Mathematical Physics	Prof.K.S.Balaji	10
Properties of Matter	Prof.R.Shankar	9
Calculus III	Prof.M.Vemuri	9
Fourth semester		
Atomic and Molecular Physics	Prof.R.Parthasarathy	10
Electromagnetic Theory II	Prof.Ravindran and Prof.Subramanian	9
Quantum Mechanics II	Prof.R.Simon	8
Analysis II (Complex Analysis)	Prof.S.Shankar	7

9.5. **Graded Courses currently in progress during the 5<sup>th</sup> Semester.** The following are the courses which I am currently doing :

Course	Instructor
Fifth semester	
Condensed Matter Physics*	Prof. Maha Seeshay
Quantum Mechanics III	Prof.P.P.Diwakaran
Statistical Physic II	Prof.V.V.Sreedhar
Laboratory I	Prof.M.V.R Rao
Laboratory II	Prof.M.V.R Rao

Information about the evaluation and grading system in CMI is available at:

<http://www.cmi.ac.in//locallinks/evaluation.php>