

# Debijyoti Sengupta

## Research Interests

Being interested in Experimental physics and Data analysis, my preferred area of research are High Energy Physics and astroparticle physics. In particular, Higgs physics and Dark Matter Physics in the context of physics beyond the standard model fascinates me. I am also interested in machine learning applications in collider experiments, and experimental particle physics in general.

## Education

2020- **University of Geneva,**  
*Ph.D. in Physics,*  
Anomaly Detection in Large R Jets.

2017–2019 **University of Calcutta,**  
*Master of Science, Physics, specialising in Particle Physics and Quantum Field Theory.*  
GPA – Overall: 4.77/6, Semester IV: 5.28/6, Semester III: 4.62/6, Semester II: 4.5/6, Semester I: 4.66/6

2014–2017 **Scottish Church College, University of Calcutta,**  
*Bachelor of Science (with Honours), Physics with Mathematics and Statistics.*  
Percentage – 69.25%

2014 **BDM International, Kolkata,**  
*Senior Secondary School, Grade 12<sup>th</sup>, Physics, Mathematics, Chemistry and Biology.*  
Percentage – 89%

2012 **BDM International, Kolkata,**  
*Secondary School, Grade 10<sup>th</sup>.*  
CGPA – 10/10

## Current Position

May 2020 - **Doctoral Student, Supervisor: Prof. Tobias Golling,**  
Present DPNC, UNIVERSITY OF GENEVA.  
**Anomaly searches in Jets using Deep Generative Networks**

## Research Experience

April 2019 - **Project Student, Supervisor: Prof. Dr. Satyaki Bhattacharya,**  
Present SAHA INSTITUTE OF NUCLEAR PHYSICS, HIGH ENERGY NUCLEAR AND PARTICLE PHYSICS DIVISION.  
**Simulation study for generation of detector level data in Collider experiments using Deep Generative Networks**

- Using *Generative Adversarial Networks* to generate images of energy deposition of Prompt and Fake photons in detectors using Tensorflow 2.0.
- Validating the generated images against Monte Carlo simulated data using Euclidean Distance as a metric.

- July 2018– February 2019 **Reconstruction of Z peak from Dielectron Drell-Yan events in CMS detector**, *Prof. Satyaki Bhattacharya, Saha Institute of Nuclear Physics, India.*
- Identification of high energy final state di-electron events.
  - Fitting the signal and background for extraction of signal strength with realistic models using RooFit framework in ROOT.
- September 2019–Present **Data Simulation for KM3Net experiment using Deep Generative Networks**, *in collaboration with Ms. Tista Mukherjee.*
- Designing model architectures to generate realistic samples for Neutrinos in Keras.
  - Training model and validation of generated data with monte carlo generated data-set.
- September 2019–Present **Simulation study of WIMPzilla decay using Deep Generative Models**, *in collaboration with Ms. Tista Mukherjee.*
- Designing model architectures to generate realistic samples for Dark Matter decay Data in Keras.
  - Training model and validation of generated data with monte carlo generated data-set for sub TeV scale dark matter.
  - Training model and validation of generated data with 'DGLAP' generated data-set for PeV scale dark matter.
- 2016-2017 **Statistical solution to the Cosmological Lithium Abundance Problem**, *self motivated.*
- Expansion of Maxwell Boltzmann distribution up to second order in Energy.
  - Calculation of Reaction rates using the modified distribution.
  - Estimation of independent parameter for reconciliation of observed and predicted values.

## Projects

- 2018 **Dynamics of a Maxwellian Gas in a 2D box** [code].
- Designing a Physics engine to simulate gas particles in a box using **Processing**.
  - Study of evolution of spatial density of gas as a function of energy loss at the walls.
  - Analysis of data using **Mathematica** and generation of animated population hotspots.
- 2018 **Temperature Gauge using BMP-150 sensor and Arduino.**
- Implementing a temperature sensor circuit using Arduino.
  - Live data stream to monitor using Python.
- 2018 **Population dynamics in an (m x m) board populated with p species using Python** [code].
- In a population of 2 distinct elements, equilibrium can be achieved by randomly selecting a member and replacing it with the other. The limiting scenario being equal representation of both. The non trivial generalisation to P distinct elements is studied.
- 2017 **Monthly Diet Planner using PuLP optimisation using Python** [code].
- 2017 **Secret Santa Hat, a random sort implementation in Python** [code].

## Technical Skills

Languages	Python, C++, C, FORTRAN, Mathematica, L <sup>A</sup> T <sub>E</sub> X
Framework	RooFit, Tensorflow, Keras
OS	Linux (Debian based), Windows
Softwares	Arduino, MS Office, Libre Office

## Language Proficiency

English	Full professional working proficiency, CEFR C1, IELTS 7.5
Hindi	Bilingual proficiency
Bengali	Native proficiency

German Limited working proficiency

## Achievements

- June 2018 Recipient of Focus Area Science Technology Fellowship.
- 2017 Ranked top 1% in National Graduate Physics Examination, India
- 2017 Ranked among top 5 percentile in Joint Admission Test Physics.
- 2015 Winner of Annual student Seminar, Department of Physics, Scottish Church College

## Pre-University Achievements

- 2017 Recipient of Amul Vidyasree award for academic excellence in Senior Secondary School.
- 2014 Ranked amongst top 250, internationally in Science Olympiad.
- 2012 Recipient of Ram Avatar Pratiba Purashkar for Academic excellence in Secondary School.

## Personal traits and Hobbies

I am extroverted and motivated towards learning new things. I am comfortable working individually as well as in a group. I like puzzles and often spend my free time studying and solving different chess compositions. I enjoy talking about physics and to that end I write a monthly blog by the name of **Physics Unpacked**. In my leisure time, I teach myself how to play the piano and do 3D modelling.

## References

- 1 **Satyaki Bhattacharya**,  
*Professor*,  
High Energy Nuclear and Particle Physics Division, SINP, India,  
`satyaki.bhattacharya@cern.ch`.
- 2 **Anirban Kundu**,  
*Professor*,  
Department of Physics, University of Calcutta,  
`anirban.kundu.cu@gmail.com`.