

# Abhishek Nag

## Curriculum Vitae

Room No - E005, IISER Kolkata  
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### Area of Interest

High Energy Physics    Understanding standard model and experimental search for new physics physics beyond Standard Model, Precision measurements of the Standard, Data analysis for experimental study of Higgs Boson, top quarks, rare decays of charged Kaons and dark matter, Detector simulation and development.

### Education

- 2012 - 2017    **Integrated BS-MS Dual Degree, 5th year**,  
Indian Institute of Science Education and Research (IISER), Kolkata, **CGPA – 8.49/10**  
Department of Physical Sciences
- 2012    **Senior School Certificate Examination (12<sup>th</sup> standard)**  
M P Education Centre, Kanpur, **Percentage – 93.2%**  
Central Board For Secondary Education
- 2010    **Indian Certificate of Secondary Education Examination (10<sup>th</sup> standard)**  
Dr. Virendra Swarup Education Centre, Kanpur, **Percentage – 93.3%**  
Council for the Indian School Certificate Examination

### Publication/Proceeding

- 2015    **Development of Triple-GEM detector for a heavy ion physics experiment**  
Authors: A. Bhardwaj, K. Biswal, R. Gupta, **A. Nag**, A. Nanda, R. N. Patra, S. Rudra, S. S. Sahoo, P. Bhattacharya, S. Biswas, B. Mohanty, T. K. Nayak, P. K. Sahu and S. Sahu  
**Proceedings of the DAE Symposium on Nuclear Physics, Volume 60, (2015), 962-963**
- 2017    Poster presentation on **Simulation of gamma detector using GEANT4**  
Author: **A. Nag**, in National Conference on **Advanced Detectors for Nuclear, High Energy and Astroparticle Physics, 2017** at **Bose Institute, Kolkata, India**

### Academic Achievements

- Recipient of **INSPIRE** fellowship (2012-2017), Department of Science and Technology (DST), Government of India
- Recipient of **Young researchers grants** for poster presentation in National Conference on **Advanced Detectors for Nuclear, High Energy and Astroparticle Physics, 2017**
- Selected for the 10<sup>th</sup> Winter School on Astro-Particle Physics (**WAPP**) 2015, organized by Bose Institute, Kolkata and Tata Institute of Fundamental Research, Mumbai.
- Selected for BSc. Summer Program at Inter University Accelerator Centre, New Delhi

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## Research Experience

### MS Thesis

#### **2016-2017 Analysis of Beam-test data of the proposed CMS Phase II Tracker modules**

Supervisors Prof. Suchandra Dutta, *Saha Institute of Nuclear Physics (SINP), Kolkata*

Dr. Ananda Dasgupta, *IISER, Kolkata*

Description The silicon tracking system of the Compact Muon Solenoid (CMS) experiment at the Large Hadron Collider (LHC) at CERN needs to be replaced before the High Luminosity (HL-LHC) operation scheduled to start in 2023. A few prototype detector modules have been constructed. They were put under particle beam facility at CERN and we are studying their performance in detail. The properties we check are mainly the efficiency to detect charged particle crossing the detector, the position measurement precision etc. The performance of ideal detector and irradiated detectors are also compared to understand the effect of the radiation damage.

### Semester Projects

#### **Autumn 2016 QCD and Collider Physics**

Supervisor Dr. Ritesh Kumar Singh, *IISER, Kolkata*

Description Study of QCD lagrangian, properties of asymptotic freedom and colour confinement, deep inelastic scattering and parton model, production of jets, heavy quarks and hadronization models. Learning MADGRAPH for QCD event generation.

#### **Autumn 2016 Path integrals and Standard Model**

Supervisor Dr. Ananda Dasgupta, *IISER, Kolkata*

Description In this reading project we studied path integral for scalar fields, fermions and quantization of electromagnetic field. Also a introduction of the Standard Model (SM), fermion masses, the SM parameters and theories beyond the Standard Model

#### **Spring 2016 Detector Simulation using GEANT4**

Supervisor Dr. Ritesh Kumar Singh, *IISER, Kolkata*

Description Using GEANT4 I designed NaI scintillation detector and performed simulation of  $Co^{60}$  gamma source and obtained the MCA spectrum statistically from the simulated energy deposited data using R programming.

## Internships

### 2015 Measurement of Gain Uniformity of single mask triple-GEM detector

Supervisors Prof. Bedangadas Mohanty, Dr. Saikat Biswas,  
*National Institute of Science Education & Research, Bhubaneswar*

Description I studied the working of Gas Electron Multiplier (GEM) detector to be used in ALICE TPC upgrade and carried out experiments for long term stability test of the GEM detector. I also measured and tested the relative gain uniformity of the triple-GEM detector with and without  $Sr^{90}$  source in  $Ar/CO_2$  in 80/20 volume ratio.

### 2015 Study of Parton Distribution Functions using LHAPDF

Supervisor Prof. Shashikant Dugad, *Tata Institute of Fundamental Research (TIFR), Mumbai*

Description I was introduced to the Standard model of Particle physics and studied about the parton distribution functions (PDFs). I also analysed the behaviour of various PDF sets using LHAPDF at leading order (LO), next to leading order (NLO) and next-to-next leading order (NNLO). The data was generated by writing programs in C++ and plotted using ROOT framework.

### 2014 Beam Optics using Quadrupole and Solenoid magnet

Supervisor Mr. Anuraag Misra, *Variable Energy Cyclotron Centre (VECC), Kolkata*

Description In this project I studied about beam physics, beam optics, beam transfer matrices in solenoid and quadrupole magnets with thick and thin lens approximation and also did simulation using MATLAB for the same.

### 2014 Studies of 2.45 GHz microwave ion sources

Supervisor Dr. Gerard Rodrigues, *Inter University Accelerator Centre (IUAC), New Delhi*

Description I studied about the plasma, the plasma parameters and did few experiments using the ion source. I also did simulation of the multi-electrode extraction system of the ion source using SCALA and verified the output beam current with that of simulated data. Using the experimental data I studied the ion source characteristics like beam intensities, beam stability and variation of these parameters as a function of source parameters.

### 2013 Gamma Ray Spectroscopy with HPGe Detector

Supervisor Prof. H. P. Sharma, *Banaras Hindu University (BHU), Varanasi*

Description I did energy calibration of gamma rays using a standard  $^{152}\text{Eu}$  source. I studied about the types of interaction of gamma rays with matter, the various gamma ray detectors like the Geiger Counter, Scintillation detectors and in details about Hyper Pure Germanium detectors, the working principle of these detectors and their configurations. I also studied about the components used for signal processing of the output pulse.

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## Theoretical Knowledge

Courses Advanced Classical Mechanics, Advanced Quantum Mechanics, Statistical Mechanics, Advanced Electrodynamics, Nuclear Physics, Condensed Matter Physics, Quantum Field Theory, High Energy Physics, Astrophysics, Group Theory, Computational Physics, Numerical Analysis, Statistics.

## Computation Skills

Languages C++/C, Python, Fortran, ROOT and R

Packages Geant4, MadGraph, LHAPDF, Matlab

## Skills for experimental research work

Nuclear Lab Photo-Multiplier Tubes, MCA, SCA, Scintillation and GM detector

Advanced Hands-on experience of working with **GEM** detector, **HPGe** detector and Microwave Ion source.

## Teaching Experiences

Spring 2016 Teaching Assistant of **Basic Nuclear Physics** (Lab and Theory) course at IISER Kolkata

Autumn 2016 Teaching Assistant of **Computational Physics** (Lab) course at IISER Kolkata

## Schools and Workshops Attended

2017 Natinal Conference on Advanced Detectors for Nuclear, High Energy and Astroparticle Physics at Bose Institute, Kolkata

2015 10<sup>th</sup> Winter School on Astro-particle Physics at Bose Institute, Darjeeling.

2013 National Workshop on Optics and Photonics for Engineering Application at National Institute of Technology, GOA.

2013 Winter School on Photonics at IISER, Kolkata.

## References

### ○ Prof. Suchandra Dutta

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*Saha Institute of Nuclear Physics, Kolkata*

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### ○ Dr. Ananda Dasgupta

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