Curriculum Vitae

Name:	Prayag Yadav	**Date of Birth:**	25 April 2001
Age:	22 years	**Nationality:**	Indian
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Education

- *Integrated Master of Science in Physics*
  - **University:** University of Hyderabad, India
  - **Joined:** August 2019
  - **Duration of course:** 5 years (2019-2024)
  - **Expected date of completion:** August 2024 (Currently in the 10th semester which is the last semester)
  - **Cumulative GPA:** 8.64 (of the last 9 semesters)

- *Intermediate*
  - **School:** Mount Carmel Senior Secondary School, Cement Nagar, India
  - **Subjects:** Physics, Maths, Chemistry, Biology, English
  - **Board of Examination:** Central Board of Secondary Education (CBSE)
  - **Duration:** 2 years (July 2017 to July 2019)
  - **Percentage of marks obtained:** 92.8%

- *Matriculation*
  - **School:** Vianney Vidya Mandir, Ghugus, India
  - **Subjects:** Physics, Chemistry, Maths, Biology, English literature, English grammar, Home Science
  - **Board of Examination:** Indian Certificate of Secondary Education (ICSE)
  - **Year of Completion:** 2017
  - **Percentage of marks obtained:** 89%

Master's Thesis

Project Title: "Search for dark matter in the Higgs to two bottom jets channel with large missing transverse energy."
Supervisor: Dr Bhawna Gomber, University of Hyderabad
Description:

- Among the many open questions in physics, the question of what Dark Matter is, is a mysterious one.
- In this thesis, I study a specific 'simplified model' of dark matter. The simplified model is a supersymmetric model called the two Higgs doublet model - a (2HDMa). The 2HDMa model introduces a new pseudoscalar 'a' which mediates the interaction between the Dark sector (denoted by χ and $\bar{\chi}$) , and the usual standard model particles.
- The signal signature is a high missing transverse momentum and a standard model Higgs which decays to two bottom quarks. These bottom quarks produce particle jets which are identified as 'b-jets' using a b-tagging algorithm.
- The analysis involves the identification of the signal (large $p_T^{miss} + H \to b\bar{b}$) from various backgrounds which are estimated by defining control regions and by Monte-Carlo simulation.
- I use the COFFEA framework (Columnar Object Framework For Effective Analysis) as my analysis tool.
- The analysis is originally going on at the University of Wisconsin, Madison. I collaborate with the Wisconsin's group to perform control region studies.
- The two major backgrounds for this analysis are top pairs ($t\bar{t}$) and $Z \to \nu\bar{\nu}$. These two backgrounds are estimated by estimating four different control regions: single muon, single electron, double muon and double electron. Currently I am working on estimating the muon control region.
- My aim is to push the analysis forward by helping with control region estimation.

Internships and other projects

- *Internship with CMS group at University of Hyderabad*
  Supervisor: Dr Bhawna Gomber
  Duration: 20th July 2022 to 4th July 2023
  - Before starting my masters project, I did an internship with the CMS (Compact Muon Solenoid) Group at the University of Hyderabad. I did this in parallel to my coursework classes.
  - During this time, I learnt the basics of analysis in experimental HEP.
  - I learnt a lot of tools: C++, ROOT, CMSSW, Python, COFFEA, bash scripting and submitting jobs to dask and HTCondor schedulers.

- o I took up the job of setting up and maintaining the newly bought server for my lab. I learnt how to install RHEL based enterprise Linux on the server, installed ROOT and other HEP relevant software, deployed containerized solutions to HEP analysis like singularity and docker containers, hosted an internal Jupyterhub server with containerized backends.
- o At the physics analysis part of things, I helped the PhD students with estimation of dielectron backgrounds in their analyses using ROOT and C++.
- *Project in experimental nuclear physics*
Title: 'Study of entanglement of photons in para-positronium decay and its implications'
Supervisor: Prof. Rudrajyoti Palit
Duration: (May 2021 to July 2021) and (Dec 2021 to Jan 2022)
  - o I did a reading project on the above-mentioned title. I learnt in detail about Gamma-ray spectroscopy and double Compton scattering cross sections.
  - o I focused on the use of segmented HPGe detectors to detect the correlation between two entangled photons produced as a result of a positronium decay ($e^+ + e^-$).
  - o I learnt about the signal processing and data acquisition required for such an analysis. I also learnt about CZT detectors and NaI (Tl) gamma spectroscopy.
  - o At the end of my project, my guide posed a problem. The problem was to find the relative contributions of Compton Scattering and Photoelectric absorption in a full photopeak corresponding to an E=0.511MeV. I solved the problem by creating a simulation in python from scratch.

Technical Skills

- Working experience in Python programming and use of modern data analysis tools relating to high energy physics: COFFEA Framework (Columnar Object Framework For Effective Analysis), uproot, awkward array, boost histogram hist, NumPy, dask, HTCondor, matplotlib, pandas, SciPy etc.
- Working experience in C++, ROOT Framework, pyROOT and CMSSW.
- Familiarity with other languages: Fortran, HTML, CSS, familiarity using Tailwind CSS, JavaScript, bash and octave.
- Very good experience with the GNU/Linux operating system. Working experience with Debian based and RHEL based systems. Worked with docker, singularity and Jupyterhub.
- Familiar with machine learning and Neural Networks. Know the basics of ANN, RNN and CNN and their implementation using Keras and TensorFlow. Deployed TensorFlow docker and singularity containers to utilize hardware acceleration through Nvidia GPU in my project lab servers.

Workshops, Conferences and Volunteering work

- *Machine Learning Workshop | University of Hyderabad*
Date: 26 Oct 2022 to 28 Oct 2022
  - o Learnt the basics of ANN, CNN and RNN
  - o Hands-on training in Machine Learning and Neural Networks
  - o Hands-on experience with Keras and TensorFlow
  - o Created a simple neural network to separate proton beam halo data from hadron data.
- *ICFAST Conference | University of Hyderabad*
Date: 9 Sept 2022 – 12 Sept 2022
  - o Attended all the talks given by Indian and Japanese professors.
  - o Attended poster sessions by scholars from all over the country.
- *Volunteered for Vigyanotsav*
Date: Jan 2020 and Aug 2023
  - o A science fest hosted by the Junior Science Club, University of Hyderabad.
  - o Demonstrated and explained superconductivity to school students by levitating a High T_c superconductor over a magnet.

Language Proficiency

- **English:** Fluent in reading, writing, speaking and listening.
- **Hindi:** Native speaker. Fluent in reading, writing, speaking and listening.

Academic achievement

- NIUS (National Initiative for Undergraduate Studies) Scholar, HBCSE, TIFR
- Appointed as the Student's Representative in the Grievance council, College of Integrated Studies, University of Hyderabad for the year 2020.

- First ranker in the school in CBSE XII examination
- Felicitated by district MLA for excellence in studies.
- Fourth ranker in the district in ICSE X examination
- Felicitated by district MLA for excellence in studies.

Hobbies

- DJing, Music production, trying out new technologies related to music production.
- Playing chess, trying out new opensource ware and freeware and Linux distributions, making a website, and anything tech related, I enjoy.