Agni Keyoor Purani

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Date of Birth: July 31, 2002
Gender: Male
Nationality: Indian
Interests: Particle Physics Phenomenology, model building and Experimental Analysis of data from colliders

Education

Indian Institute of Technology Kharagpur — West Bengal, India
Integrated MSc. in Physics (Minor in Mathematics), GPA: 9.48/10.00 — 2019–2024(Expected)

- **Thesis topic:** Composite Higgs Models (under Prof. Tirtha Sankar Ray)
- Various possibilities of form factors and need for such models.
- Using well-motivated form-factor to find signatures that can be found in present and future collider experiments.

Central Board of Secondary Education — India
All India Senior School Certificate Examination (Class 12), Score: 96% — 2019

Central Board of Secondary Education — India
All India Secondary School Examination (Class 10), CGPA: 10.00/10.00 — 2017

Research Internships

Particle Identification using CNN on NA62 Calorimeter (2023)
Conducted under the guidance of Prof. Douglas Bryman at TRIUMF, Canada, facilitated by Mitacs GRI 2023.

- Applied Convolutional Neural Networks (CNNs using PyTorch) to NA62 Calorimeter for signal separation.
- Consistently distinguished suppressed K^+ to $\pi^+\bar{\nu}\nu$ decay from μ background.
- Analyzed photomultiplier data for Ring Imaging Cherenkov detector for signal enhancement.
- Participated in TRIUMF Science Week 2023 and GRIDS School 2023, assisting with muon detector supervision.

Symmetry Methods in Physics (2020-2023)
Finite Groups and semi-simple Lie algebras under Prof. Ananda Dasgupta, IISER Kolkata, through the NIUS program.

- Used finite group theory for physics problems (Molecular vibrations, selection rules).
- Determined structure constants of semi-simple Lie Groups based on root systems or Cartan Matrix.
- Explored Spontaneous Symmetry Breaking through Group Theory and Measure Theory.

Reconstruction of low pT taus (2022)
With Prof. Elisabetta Gallo and Dr. Andrea Cardini at DESY (CMS group), Hamburg, via the DAAD WISE 2022 program.

- Suggested and contributed to techniques for reconstructing low pT taus from b decays.
- Utilized CERN's ROOT for data analysis, particularly focusing on 3-prong decays of B mesons to J/ψ.
- Applied Boosted Decision Trees (BDTs) with class balance weights to discern signal from background.

Design Study of Scintillating Crystals as Electromagnetic Detectors using Geant4 (2021)
Utilized Geant4 to study scintillating crystals under Prof. Kajari Mazumdar at TIFR Mumbai.

- The dimensions and material of a scintillating crystal was analyzed with respect to the energy deposited in it.
- Higher energy deposition percentage is favourable but the crystal size cannot be too big due to the effort required to make them.
- Some techniques were discussed on how to detect particles by cleverly using the discrete size of crystals.

Course Projects / Term Papers

- **Short and Long time prediction of stocks using MC Methods (2023)**, Stochastic Process course (MA41017) [link]
- **On the radiation by charged objects in a gravitational field (2021)**, Classical Mechanics 2 course (PH31007) [link]
- **Theoretical Understanding Of Kármán Vortex Street (2021)**, Fluid Mechanics course (PH20101) [link]
- **Modified Linear Tangent Guidance (2020)**, Classical Mechanics course (PH20001) [link]

Skills

- **Programming Languages:** FORTRAN 90, C, C++ (STL, OpenCV, Geant4), ROOT CERN, Octave, HTML, CSS, Arduino, LaTeX, Python (OpenCV, pandas, NumPy, SciPy, scikit-learn, flask, Matplotlib, Qiskit, PyTorch, ml-flow), OpenMPI (C++ and FORTRAN), Bash scripting, ROS.
- **Applications and Tools:** MATLAB Simulink, SolidWorks, LTSpice, ROS, SQL, HTcondor, Slurm scheduler.

Certifications

- **Qiskit Global Summer School**, IBM Quantum August 2020
- **Deep Learning Specialization**, deeplearnig.ai, Coursera August 2020

Languages

- **English:** Excellent proficiency
- **Hindi:** High proficiency
- **Gujarati:** Moderate proficiency
- **German:** A1-level proficiency
- **French:** A1-level proficiency

Scholarships and Academic Awards

- Mitacs GRI 2023 program, Mitacs, Canada 2023
- WISE 2022 program, German Academic Exchange Service (DAAD) 2022
- Inspire Scholarship for Higher Education (SHE), Dept. of Science & Technology, Govt. of India 2019–Current
- NIUS Physics Fellowship, HBCSE (TIFR), India 2020–2022
- JEE Advanced, National Rank 5877 (among about 173,000 registered) 2019
- JEE Main, National Rank 3020 (among about 1.15 MN. registered) 2019

Extracurricular Activities

- Software Team Member, Aerial Robotics Kharagpur, IIT Kharagpur) 2020–Current
  Used deep learning, computer vision and other methods to achieve special tasks with the Drones. Some other projects involved super resolution, a document scanner and kalman filter implementation. Also designed the website for the lab.
- Student Mentor, Student Mentorship program, Student Welfare Group, IIT Kharagpur 2019–2021-2022
  Had the responsibility to guide and solve academic and other related issues faced by three junior students from the physics department in the campus.
- Programming and Data Structures Doubt Sessions, Student Welfare Group, IIT Kharagpur 2019–2020-2021
  Designed quizzes and took certain lectures for freshers who had been exposed to programming for the first time.
- Nexus Competition held during Kshitij (Annual Technomanagement fest of IIT Kharagpur) 2020
  Awarded first prize for making a bot that recognises shapes, colours and barcodes and makes decisions accordingly.
- Inter Hall Ad Design Competition, IIT Kharagpur 2019–2020
  Awarded Second prize for creating a movement for saving the environment where I worked on the presentation.
- Volunteer & Unit Leader at National Service Scheme 2019–2021
  Led a unit of 34 volunteers and nominated for the best volunteer award in the unit for the camp in December 2019.
- PowerPoint Presentation Competition, Sahodaya, Kerala, India 2017–2018
  Awarded First Prize at the District level, where we had to create a presentation in one hour and present it based on the material/information provided.