

# Agni Keyoor Purani

**Date of Birth:** July 31, 2002

**Gender:** Male

**Nationality:** Indian

**Interests:** Particle Physics, Collider Physics and Experimental Analysis

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## EDUCATION

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### Indian Institute of Technology Kharagpur

Bachelor (Honours) and Master in Physics (Minor in Mathematics), CGPA: 9.51/10.00

West Bengal, India

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 factors and developing an effective field theory
- Finding signatures that can be found in present and future collider experiments.

### Central Board of Secondary Education

Devagiri CMI Public School, All India Senior School Certificate Examination (Class 12), Score: 96%

India

2019

### Central Board of Secondary Education

Devagiri CMI Public School, All India Secondary School Examination (Class 10), CGPA: 10.00/10.00

India

2017

## RESEARCH INTERNSHIPS

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### 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  $\mu$  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.
- Automated and developed a Python package for finding all roots, drawing Dynkin diagrams, and finding structure constants using the SymPy library.
- 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  $J/\psi$ .
- 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 were analyzed with respect to the energy deposited in it.
- Higher energy deposition percentage is favorable, 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

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- **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

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- **Programming Languages:** FORTRAN 90, C, C++ (STL, OpenCV, GEANT4), ROOT CERN, Octave, HTML, CSS, Arduino, L<sup>A</sup>T<sub>E</sub>X, Python (OpenCV, pandas, NumPy, SciPy, scikit-learn, flask, Matplotlib, Qiskit, PyTorch, ml-flow), OpenMPI (C++ and FORTRAN), Bash scripting, ROS, Mathematica.
- **Applications and Tools:** MATLAB Simulink, SolidWorks, LTSpice, ROS, SQL, HTcondor, Slurm scheduler, CalcHEP.

## CERTIFICATIONS

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

## LANGUAGES

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- **English:** Excellent proficiency
- **Hindi:** High proficiency
- **Gujarati:** Moderate proficiency
- **German:** A2-level proficiency
- **French:** A1-level proficiency

## SCHOLARSHIPS AND ACADEMIC AWARDS

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- Prof. J. C. Ghosh Memorial Prize for the highest CGPA in my class. December 2023
- 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

## IMPORTANT EXTRACURRICULAR ACTIVITIES

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- Software Team Member, Aerial Robotics Kharagpur, IIT Kharagpur 2020–Current  
*Used deep learning, computer vision, and filters to achieve special tasks with the Drones. I was also involved in web design.*
- Kerbal Space Program eSports contest, PSI(T), IISER Thiruvananthapuram February 2022  
**Awarded second prize** (team of 2) to land on Duna (Mars equivalent) planet for minimal cost (VF 3762) and time (69 days).
- Student Mentor, Student Mentorship program, Student Welfare Group, IIT Kharagpur 2021–2022  
*Guided and solved academic and other related issues faced by three junior students from the physics department on campus.*
- Programming and Data Structures Doubt Sessions, Student Welfare Group, IIT Kharagpur 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 recognizes shapes, colors, 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 was 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. Tasked to create a presentation in one hour and present it on the material provided.