Curriculum Vitae

Anil Kumar, Ph.D.

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Personal Information

Nationality	Indian
Languages	English, Hindi

Profile Summary

Postdoctoral researcher in high-energy physics with expertise in neutrino oscillations, atmospheric neutrinos, and Beyond the Standard Model (BSM) of particle physics. Experienced in large-scale data analysis, Monte Carlo simulations, and statistical analysis using Python, C++, and ROOT in HPC environments. Strong background in detector R&D, including RPC fabrication and characterization, gaseous detectors, scintillators, and photo-multipliers. Actively contributed to international collaborations such as IceCube and INO-ICAL, with 10+ peer-reviewed publications, invited talks, and conference presentations. Passionate about exploring fundamental properties of neutrinos and contributing to cutting-edge research in particle physics.

Employment History

2022 – 2025 **Post-doctoral Researcher, IceCube group, DESY, Zeuthen, Germany.**
Supervisor: Dr. Summer Blot.

Education

2016 – 2022 **Ph.D., Homi Bhabha National Institute (HBNI), Mumbai, India**.
Thesis title: *Studies on Response Uniformity of RPC and Exploring Oscillation Dip and Valley, Non-Standard Interactions, and Earths Core using Atmospheric Neutrinos at ICAL-INO detector.*
Supervisor: Prof. Sanjib Kumar Agarwalla; Co-supervisor: Prof. Supratik Mukhopadhyay
ArXiv: 2509.20094 [hep-ph]

2014 – 2016 **M.Sc. Physics, Indian Institute of Technology (IIT) Roorkee, India** (CGPA 8.310).
Thesis title: *Solving Coupled Channel Differential Equation with the R-Matrix Method Embedded on a Lagrange Mesh: An Application on ^{37}Mg.*
Supervisor: Rajdeep Chatterjee

2011 – 2014 **B.Sc. Physics, St. Stephens College, University of Delhi, India** (Percentage 81.19%).

Research Interest

Neutrino physics, neutrino oscillations, atmospheric neutrinos, Beyond the Standard Model of particle physics, neutrino decay, non-standard neutrino interactions, Lorentz invariant violation, non-unitary neutrino mixing, neutrino oscillation tomography of Earth, astrophysical neutrinos, IceCube, DeepCore, INO-ICAL, Resistive Plate Chambers, resistivity of graphite layer, electronics and instrumentation.

Skills

Data analysis	Hypothesis testing, treatment of systematic Uncertainties, Asimov/median sensitivities, statistical fluctuations, Feldmann Cousins confidence levels, Minimizers.
Experimental:	RPC fabrication and characterization, Surface resistivity of graphite layer in RPC, Gaseous detectors, Plastic scintillators, Photo-multiplier tubes (PMTs), Silicon Photo-multiplier (SiPM), NIM logic units, Data acquisition (DAQ) systems, Muon decay, Gamma spectroscopy, NaI scintillator, Liquid scintillator, HPGe, Cosmic muon veto, Neutron absorption, Field-programmable gate array (FPGA), Micro-controller (Arduino, ESP32), linear stage in XYZ motion (AEROTECH PRO165), GPIB and serial (RS232) interface, Picoammeter (KEITHLEY 6487).
Programming:	Python, C++, C, Fortran, Bash, Matlab, Microprocessor Programming (8085), PHP.
Analysis Tools	Numpy, Pandas, Matplotlib, Scipy, ROOT.
Simulation Tools	GEANT4, GENIE.
Generic Tools	Git, Jupyter Notebook, LaTeX, HTML, Markdown, Word, Excel, Powerpoint, Inkscape.
Operating Systems	Linux (Mint, Ubuntu, CentOS, Scientific Linux, and Fedora), Windows.

Miscellaneous Experience

Scientific Responsibilities

2023 – 2025 Astroparticle physics seminar organizer at DESY, Zeuthen.

Teaching

2024 **Tutorial: Feldman-Cousins Confidence Intervals**, ML4HEP, IOP, India.

Awards and Achievements

2022 **Second best talk on National Science Day**, Tezpur University, India.

2018 **Second best poster in the XXIII DAE-BRNS HEP Symposium**, IIT Madras, India.

2009 **Indira Award for highest marks in Mathematics in CBSE 10th** by Delhi Govt.

National Level Exams in Physics

2016 **Tata Institute of Fundamental Research** graduate school entrance exam (Qualified).

Graduate Aptitude Test in Engineering (GATE) (72 Rank in India).

Joint Entrance Screening Test (JEST) (481 Rank in India).

2015 **Junior Research Fellowship (JRF) and Eligibility for Assistant Professorship** (57 Rank in India).

Indian Institute of Astrophysics Screening Test (IIAST) (Qualified)

2014 **Joint Admission test for Masters (JAM)** (234 Rank in India)

Joint Entrance Screening Test (JEST) (59 Rank in India)

List of Publications*

- Papers published in International Refereed Journals (11)
- Papers communicated to International Refereed Journals (1)
- Conference Proceedings (13)

Conferences

2024 **The XXXI International Conference on Neutrino Physics and Astrophysics, Milano**.
Poster: Probing Invisible Neutrino Decay using Oscillations of Atmospheric Neutrinos at IceCube DeepCore.

2023 **EPS-HEP 2023, Hamburg, Germany**.
Talk: Latest muon neutrino disappearance results from IceCube DeepCore.
Poster: Probing the interior of Earth using oscillating neutrinos at INO-ICAL.

International Workshop on Multi-messenger Tomography of the Earth (MMTE), Paris.
Talk: Probing interiors of Earth using magnetized neutrino detector.

2022 **Multi-Messenger Tomography of Earth (MMTE 2022) Workshop, Online**.
Talk: Neutrino Oscillation Tomography of Earth with a Magnetized Detector having Charge-identification Capability.

The 23rd International Workshop on Neutrinos from Accelerators (NuFact 2022, online).
Talk: A New Approach to Probe Non-Standard Interactions in Atmospheric Neutrino Experiments.

The XXX International Conference on Neutrino Physics and Astrophysics (Online).
International Symposium on Lepton Photon Interactions at High Energies, (Online).
Poster: A New Approach to Probe Non-Standard Interactions in Atmospheric Neutrino Experiments.

2021 **The 28th International Workshop on Weak Interactions and Neutrinos (Online)**.
Poster: A New Approach to Probe Non-Standard Interactions in Atmospheric Neutrino Experiments.

The 22nd International Workshop on Neutrinos from Accelerators (NuFact, online).
Talk: A New Approach to Probe Non-Standard Interactions in Atmospheric Neutrino Experiments.
Poster: Validating the Earths Core using Atmospheric Neutrinos with ICAL at INO.

International Conference on Topics in Astroparticle and Underground Physics, (Online).
The XIX International Workshop on Neutrino Telescopes (Neutel, online).
Talk: A New Approach to Probe Non-Standard Interactions in Atmospheric Neutrino Experiments.

2020 **The XXIV DAE-BRNS High Energy Physics (HEP) Symposium (Online)**.
Talk: A New Approach to Probe Non-Standard Interactions in Atmospheric Neutrino Experiments.
Poster: Neutrino tomography of Earth using ICAL@INO.

The XXIX International Conference on Neutrino Physics and Astrophysics (Online).
Poster: From oscillation dip to oscillation valley in atmospheric neutrino experiments.

2018 **The XXIII DAE-BRNS High Energy Physics (HEP) Symposium, IIT Madras, India**.
Talk: Effect of Variation of Surface Resistivity of Graphite Layer in RPC.
Poster: Effect of Variation of Surface Resistivity of Graphite layer in RPC.

Seminars

2025 **The IIFC-vP (Indian-Institutions Fermilab Collaboration in Neutrino Physics) School, NISER, Bhubaneswar, Odisha, India.**
Poster: Probing Invisible Neutrino Decay using Atmospheric Neutrino Oscillations at IceCube DeepCore
HEP seminar, Institute of Physics, Bhubaneswar (Online).
Talk: Probing the fundamental properties of neutrinos using atmospheric neutrinos at IceCube DeepCore

2022 **National Science Day, Tezpur University, India (Online)**.
Talk: Validating the Earths Core using Atmospheric Neutrinos with ICAL at INO.

* See details in the full list of publications

Seminars (continued)

2021 **Virtual School on Flavor Structure of the Standard Model, HEP-PHENO School (Online)**.
American Physical Society (APS) April Meeting 2021 (Online).
Invisibles virtual Workshop (Online).
Talk: A New Approach to Probe Non-Standard Interactions in Atmospheric Neutrino. Experiments

HEP Seminar, Department of Physics, University of Alberta (Online).
Talk: Exploring Oscillation Dip and Valley, NSI, and Earths Core using Atmospheric Neutrinos at INO-ICAL.

Journal Club, Neutrino Astroparticle Physics Lab. Sungkyunkwan University, South Korea and Department of Physics and Astronomy, University of Utah, USA (Online).
Talk: Exploring Oscillation Dip and Valley, NSI, and Earths Core using Atmospheric Neutrinos at INO-ICAL.

HEP Journal Club, IOP, Bhubaneswar, India.
Talk: From Oscillation Dip to Oscillation Valley in Atmospheric Neutrino Experiments.

2020 **Virtual Neutrino Theory mini-workshop**.
Talk: From oscillation dip to oscillation valley in atmospheric neutrino experiments.

National Science Day, IOP, Bhubaneswar, India.
Poster: India-based Neutrino Observatory: A Mega Science Project.

2019 **The XII SERB School on Experimental High-Energy Physics at TIFR, Mumbai, India**.
Talk: Characterization of Scintillator Detector.

2018 **International Neutrino Summer School, Mainz, Germany**.
Talk: Sensitivity Studies for Signal Discovery.
Poster: Exploring Neutrino Properties using Atmospheric Neutrinos at ICAL.

2017 **The XI SERC School on Experimental High-Energy Physics, NISER, India,**.
Talk: Proportional Counter.

Schools

2025 The IIFC-vP (Indian-Institutions Fermilab Collaboration in Neutrino Physics) School, NISER, Bhubaneswar, Odisha, India.

2021 Virtual School on Flavor Structure of the Standard Model, HEP-PHENO School (Online).

Invisibles 2021 School (Online).

2019 XII SERB School on Experimental High-Energy Physics, TIFR, Mumbai, India.

2018 International Neutrino Summer School, Mainz, Germany.

2017 XI SERC School on Experimental High-Energy Physics, NISER, Bhubaneswar, India.

Projects and Activities

2017 Project: Neutron Absorption and Background Suppression due to Cosmic Veto.

2016 Project: Study of Resistive Plate Chamber and Scintillators.

2014 Organised two workshops on Basics of Electronics and Designing Power Supply in Electronics Society in St. Stephens College.

2012 – 2013 **Delhi University Innovation Project:** On the Energy, Light Characteristics and Economic Feasibility of LED Luminaires.

2012 Participated in workshop on Phoenix micro-controller at IUAC, Delhi.

Participated in organizing Science Games in National Science Fest at St. Stephens College.