

Curriculum Vitae

Anil Kumar

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Contact Information

DESY Zeuthen,
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15738 Zeuthen, Germany

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Personal Information

Birth year : 1993
Marital status : Unmarried
Nationality : Indian

Experience

Deutsches Elektronen-Synchrotron (DESY),
Zeuthen, Germany
Post-Doctoral Researcher under the IceCube Collaboration

June 2022 – Present

Education

Homi Bhabha National Institute (HBNI), August 2016 – May 2022
Mumbai, Maharashtra, India
Ph.D. under India-based Neutrino Observatory (INO)
Thesis title: Studies on Response Uniformity of RPC and Exploring Oscillation Dip and Valley,
Non-Standard Interactions, and Earth's Core using Atmospheric Neutrinos at ICAL-INO detector

Indian Institute of Technology (IIT) Roorkee,
Roorkee, Uttarakhand, India
M.Sc. Physics

July 2014 – May 2016

(CGPA 8.310)

St. Stephen's College, University of Delhi,
Delhi, India.
B.Sc. Physics

July 2011 – May 2014

(Percentage 81.19 %)

Rajkiya Pratibha Vikas Vidyalaya,
Dwarka, New Delhi, India
Senior Secondary School
Secondary School

July 2004 - March 2011

(Percentage 90.6 %)

(Percentage 90.83 %)

Leadership

Astroparticle physics seminar organizer at DESY, Zeuthen

Sep 2023 - Current

National Level Exams

- Tata Institute of Fundamental Research graduate school entrance exam, 2016 (Qualified)
- Graduate Aptitude Test in Engineering (GATE), 2016 (72 Rank)
- Joint Entrance Screening Test (JEST), 2016 (481 Rank)
- Junior Research Fellowship (JRF) and Eligibility for Assistant Professorship, Dec 2015 (57 Rank)
- Indian Institute of Astrophysics Screening Test (IIAST), 2015 (Qualified)

- Joint Admission test for Masters (JAM), 2014 (234 Rank)
- Joint Entrance Screening Test (JEST), 2014 (59 Rank)

Awards

- 2022: Second position in best talk on National Science Day at Tezpur University, Tezpur, Assam, India.
- 2018: Second position in best poster in the XXIII DAE-BRNS High Energy Physics (HEP) Symposium, IIT Madras, India
- 2009: Indira Award for highest marks in Mathematics in CBSE 10th by Delhi Govt

Research Interest

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

Skills

Data analysis: Hypothesis testing, treatment of systematic Uncertainties, Asimov/median sensitivities, statistical fluctuations, Feldmann Cousins confidence level, Minimizers

Experimental experience: RPC fabrication and characterization, Surface resistivity of graphite in RPC, Gaseous detectors, Plastic scintillators, 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), Arduino micro-controller, linear stage in XYZ motion (AEROTECH PRO165), GPIB and serial (RS232) interface, picoammeter (KEITHLEY 6487).

Programming and Scripting Languages: Python, C++, C, Fortran, Matlab Microprocessor Programing (8085), HTML, PHP

Analysis Tools: Numpy, Pandas, Matplotlib, Scipy

Simulation Tools: ROOT, GEANT4, GENIE

Generic Tools: Git, Jupyter Notebook, Latex, MS Word, Excel, Powerpoint, Inkscape, Kdenlive
OS : Linux (Mint, Ubuntu, CentOS, Scientific Linux, and Fedora), Windows

List of

Publications*

- Papers published in International Refereed Journals (10)
- Papers communicated to International Refereed Journals (1)
- Conference Proceedings (13)

Teaching

Tutorial on *the construction of Feldman-Cousins Confidence Intervals* at School-cum-workshop on Machine Learning for Particle and Astroparticle Physics (ML4HEP), 1-13 Jul, 2024, Institute of Physics, Bhubaneswar, India

Talks

1. **Latest muon neutrino disappearance results from IceCube DeepCore**
The European Physical Society Conference on High Energy Physics (EPS-HEP 2023), University of Hamburg, Germany, Aug 21 - 25, 2023
2. **Probing interiors of Earth using magnetized neutrino detector**
International Workshop on Multi-messenger Tomography of the Earth (MMTE 2023), APC-Université Paris Cité, Paris, France, Jul 4 - 7, 2023

* See details in the full list of publications

3. **Neutrino Oscillation Tomography of Earth with a Magnetized Detector having Charge-identification Capability**
Multi-Messenger Tomography of Earth (MMTE 2022) Workshop - online, Jul 30 - 31, 2022
4. **Validating the Earth's Core using Atmospheric Neutrinos with ICAL at INO**
National Science Day, Tezpur University, Tezpur, Assam, India - online, Mar 1, 2022
5. **A New Approach to Probe Non-Standard Interactions in Atmospheric Neutrino Experiments**
 - The 23rd International Workshop on Neutrinos from Accelerators (NuFact 2022, online), Jul 31 - Aug 6, 2022
 - The 22nd International Workshop on Neutrinos from Accelerators (NuFact 2021, online), Sep 6 - 11, 2021
 - Virtual School on Flavor Structure of the Standard Model, HEP-PHENO School (Online), Aug 31 - Sep 12, 2021
 - 17th International Conference on Topics in Astroparticle and Underground Physics, (TAUP 2021, online), Aug 26 - Sep 3, 2021
 - American Physical Society (APS) April Meeting 2021 - online, Apr 17 - 20, 2021
 - The XIX International Workshop on Neutrino Telescopes (Neutel 21), Padova (Italy) – online, Feb 18-26, 2021
 - The XXIV DAE-BRNS High Energy Physics (HEP) Symposium (held online), NISER, Bhubaneswar, India, Dec 14 - 18, 2020
6. **Exploring Oscillation Dip and Valley, NSI, and Earth's Core using Atmospheric Neutrinos at INO-ICAL**
 - HEP Seminar, Department of Physics, University of Alberta, Canada, Jul 7, 2021
 - Journal Club, Neutrino Astroparticle Physics Lab. Sungkyunkwan University (SKKU), Republic of Korea (South Korea) and Department of Physics and Astronomy, University of Utah, USA, May 28, 2021
7. **From Oscillation Dip to Oscillation Valley in Atmospheric Neutrino Experiments**
Insitute of Physics (IOP), Bhubaneswar, HEP Journal Club, Mar 11, 2021
8. **From oscillation dip to oscillation valley in atmospheric neutrino experiments**
Virtual Neutrino Theory mini-workshop, Sep 21 - 23, 2020
9. **Characterization of Scintillator Detector**
The XII SERB School on Experimental High-Energy Physics at TIFR, Mumbai, India, Jan 7-27, 2019
10. **Effect of Variation of Surface Resistivity of Graphite Layer in RPC**
The XXIII DAE-BRNS High Energy Physics (HEP) Symposium 2018 held at IIT Madras, India, Dec 10-14, 2018
11. **Sensitivity Studies for Signal Discovery**
International Neutrino Summer School 2018 at Schloss Waldthausen near Mainz, Germany, May 21 - Jun 1, 2018
12. **Proportional Counter**
the XI SERC School on Experimental High-Energy Physics at NISER, Bhubaneswar, India, Nov 07 - 27, 2017

**Poster
Presentations**

1. **Probing Invisible Neutrino Decay using Oscillations of Atmospheric Neutrinos at IceCube DeepCore**
The XXXI International Conference on Neutrino Physics and Astrophysics (Neutrino 2024), Milano, Italy, Jun 16 - 22, 2024
2. **Probing the interior of Earth using oscillating neutrinos at INO-ICAL**
The European Physical Society Conference on High Energy Physics (EPS-HEP 2023), University of Hamburg, Germany, Aug 21 - 25, 2023
3. **Validating the Earth's Core using Atmospheric Neutrinos with ICAL at INO**
The 22nd International Workshop on Neutrinos from Accelerators (NuFact 2021, online), Sep 6 - 11, 2021
4. **A New Approach to Probe Non-Standard Interactions in Atmospheric Neutrino Experiments**
 - The XXX International Conference on Neutrino Physics and Astrophysics (Neutrino 2022), online, May 30 - Jun 4, 2022
 - The 30th International Symposium on Lepton Photon Interactions at High Energies, online, Jan 10 - 14, 2022
 - The 28th International Workshop on Weak Interactions and Neutrinos (WIN 2021, online), Jun 7 - 12, 2021
 - Invisibles virtual Workshop, May 31 - Jun 4, 2021
5. **Neutrino tomography of Earth using ICAL@INO**
The XXIV DAE-BRNS High Energy Physics (HEP) Symposium (held online), NISER, Bhubaneswar, India, Dec 14 - 18, 2020
6. **From oscillation dip to oscillation valley in atmospheric neutrino experiments**
The XXIX International Conference on Neutrino Physics and Astrophysics (Neutrino 2020) (held online), Jun 22 - Jul 2, 2020
7. **India-based Neutrino Observatory: A Mega Science Project**
National Science Day at Institute of Physics (IOP), Bhubaneswar, India on Feb 28, 2020
8. **Effect of Variation of Surface Resistivity of Graphite layer in RPC**
The XXIII DAE-BRNS High Energy Physics (HEP) Symposium 2018 held at IIT Madras, India, Dec 10-14, 2018
9. **Exploring Neutrino Properties using Atmospheric Neutrinos at ICAL**
International Neutrino Summer School 2018 at Schloss Waldthausen near Mainz, Germany, May 21 - Jun 1, 2018

**Conferences &
Workshop
attended**

1. The XXXI International Conference on Neutrino Physics and Astrophysics (Neutrino 2024), Milano, Italy, Jun 16 - 22, 2024
2. The European Physical Society Conference on High Energy Physics (EPS-HEP 2023), University of Hamburg, Germany, Aug 21 - 25, 2023
3. International Workshop on Multi-messenger Tomography of the Earth (MMTE 2023), APC-Université Paris Cité, Paris, France, Jul 4 - 7, 2022
4. Multi-Messenger Tomography of Earth (MMTE 2022) Workshop - online, Jul 30 - 31, 2022
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8. The 22nd International Workshop on Neutrinos from Accelerators (NuFact 2021, online), Sep 6 - 11, 2021
9. The 17th International Conference on Topics in Astroparticle and Underground Physics, (TAUP 2021, online), Aug 26 - Sep 3, 2021
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11. Invisibles virtual Workshop, May 31 - Jun 4, 2021
12. American Physical Society (APS) April Meeting 2021 - online, Apr 17-20, 2021
13. The XIX International Workshop on Neutrino Telescopes (Neutel 21), Padova (Italy) – online, Feb 18-26, 2021
14. Virtual Neutrino Theory mini-workshop, Sep 21-23, 2020
15. The XXIV DAE-BRNS High Energy Physics (HEP) Symposium (held online), NISER, Bhubaneswar, India, Dec 14 - 18, 2020
16. The XXIX International Conference on Neutrino Physics and Astrophysics (Neutrino 2020) (held online), Jun 22 - Jul 2, 2020
17. The XXIII DAE-BRNS High Energy Physics (HEP) Symposium 2018 held at IIT Madras, India, Dec 10-14, 2018

School attended

1. Virtual School on Flavor Structure of the Standard Model, HEP-PHENO School (Online), Aug 31 - Sep 12, 2021
2. Invisibles 2021 School, Apr 12 - May 7, 2021
3. XII SERB School on Experimental High-Energy Physics at TIFR, Mumbai, India, Jan 7-27, 2019
4. International Neutrino Summer School 2018 at Schloss Waldthausen near Mainz, Germany, May 21 - Jun 1, 2018
5. XI SERC School on Experimental High-Energy Physics at NISER, Bhubaneswar, India, Nov 07 - 27, 2017

Projects and Activities

Project on Neutron Absorption and Background Suppression due to Cosmic Veto.	2017
Project on Study of Resistive Plate Chamber and Scintillators.	2016
M.Sc. Thesis Project on Solving Coupled Channel Differential Equation with the R-Matrix Method Embedded on a Lagrange Mesh: An Application on ^{37}Mg .	2015 - 2016
Organised 2 workshops on “Basics of Electronics” and “Designing Power Supply” in Electronics Society in St. Stephen’s College.	2014
Delhi University Innovation Project	2012 – 2013
“Delhi University Innovation Project: On the Energy, Light Characteristics and Economic Feasibility of LED Luminaires” aimed for feasibility of replacing current Luminaries by the LED Luminaires in the offices, colleges and homes.	
Participated in Phoenix workshop at IUAC	2012
Participated in organising Science Games in National Science Fest (NSF) 2012 at St. Stephen’s College.	2012