

KARTIK TIWARI

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EDUCATION

- Masters in Astrophysics (no grades to show yet) | **University of Bonn (BCGS Scholarship)** (Bonn, Germany) 2025
- Postgraduate Diploma in Advanced Studies and Research: GPA 3.86/4.00 (*Magna cum Laude*) | **Ashoka University** 2023
- B.Sc. Physics (Hons) with Philosophy Minor: GPA 3.85/4.00 (*Magna cum Laude*) | **Ashoka University** (Delhi, India) 2022
- High School STEM Diploma, SSE (CBSE): 9.4/10 CGPA; AISCE (CBSE): 82.4 % | **St. Paul's H. S. School** (Indore, India) 2019

FORMAL RESEARCH EXPERIENCE

Lichtenberg Group for History and Philosophy of Physics, Uni of Bonn **Supervisor(s) - Prof. Dennis Lehmkuhl, Prof. Erik Curiel**
Winter 2021 (Ongoing) - Masters YR1

- Understanding technical developments in GR during 1955-1975 through the personal archives of Wheeler, Penrose, Bondi, etc.
- Studying how the conceptual machinery to assemble Petrov-Pirani-Penrose classification of vacuum spacetimes was developed

Department of Physics, Ashoka University [Capstone Thesis Research] **Supervisor - Prof. Dipankar Bhattacharya**
Summer 2022 to Spring 2023 - Undergraduate YR4

- Developed a [gravitational lensing and radiative transport program](#) to simulate pulse profile dependencies of Neutron Stars
- Extensions for radiative transfer calculations in Neutron Star atmospheres and including birefringence effects currently in progress

Hydrodynamics Lab - Ashoka University **Supervisor - Prof. Pramoda Kumar**
Spring 2022 - Undergraduate YR3

- Experimentally and analytically probed the relationship between ripples and Schwarzschild geometry in Hydraulic Jumps
- Proposed an extension for investigating lensing effects in hydraulic white hole analogs for geodesic computations

Wolfram Physics Project **Supervisor(s) - Dr. Stephen Wolfram, James Boyd**
Monsoon 2021 - Undergraduate YR3

- Constructed a novel Completeness-Consistency framework for Axiom Systems using Subgraph Isomorphisms of Multiway Systems
- Investigated correspondence between Gauge Choices in ADM Numerical Relativity and foliation functions of Causal Graphs

Indian Space Research Organization - Space Applications Center and IIT, Indore **Supervisor - Prof. Hari Hablani**
Summer 2020 - Undergraduate YR1

- Developed simulations of Multipath Error for NavIC frequencies and compared against data collected by project collaborator
- Drafted majority of the research paper that yielded a conference presentation, publication and a Best Paper Award

IIT, Indore - Discipline of Astronomy, Astrophysics and Space Engineering **Supervisor - Prof. Hari Hablani**
Summer 2020 - Undergraduate YR1

- Programmed 500+ lines of Python code to simulate several re-entry strategies for manned and unmanned space vehicles
- Analyzed atmospheric re-entry corridors for space vehicles as governed by heat rate and structural integrity

ADDITIONAL ACADEMIC ENGAGEMENTS

Universidad Nacional Autónoma de México **Mentor - Prof. Miguel Alcubierre**
Summer 2021 - Undergraduate YR2

- Worked on a minimal NR code to simulate Schwarzschild spacetime by solving conformally decomposed ADM-York equations
- Studied canonical formulation of GR, gauge choices for foliating spacetime and advanced numerical techniques

Shape Dynamics Research Collaboration **Mentor - Dr. Julian Barbour**
Monsoon 2021 - Undergraduate YR3

- Performed numerical experiments related to complexity, central configurations and best-matching in Shape Dynamical contexts
- Studied alternate symmetry choices and Dirac's constraint algebra in geometrodynamical formulation of Shape Space

PUBLICATIONS AND CONFERENCE TALKS

- Tiwari, K. (2024), *Godel, Penrose and Paraconsistency*, Annual Meeting of German Physical Society, Berlin (Germany)
- Tiwari, K. (2023), *Motivating Phenomenologically Distinct Present in Relativistic Temporal Logic*, 18th Triennial Conference of the International Society for Studies of Time, Yamaguchi (Japan)
- Tiwari, K., Althaf, A., Hablani, H. (2022) *Short-Delay Multipath Errors in NavIC Satellite Signals for a Stationary Receiver*, Communications in Computer and Information Science, Springer (ISSN: 1865-0929)
- Tiwari, K., Althaf, A., Hablani, H. (2021) *Short-Delay Multipath Error in NavIC Satellite Signals*, Conference Proceedings of IAF's 72nd International Astronautical Congress, Dubai (UAE)

TECHNICAL PROFICIENCY

- **Languages:** Python, Julia, C/C++, MATLAB, Wolfram Language, HTML, CSS, JavaScript
- **Modelling Tools and Libraries:** EinsteinToolkit, athena++, PLUTO, GADGET, MESA, MATLAB Simulink, TensorFlow Keras
- **Visualization Tools and Libraries:** SAOds9, VisIT, ParaView, HDF5, FITS
- **HPC Tools and Libraries:** Bash, CUDA, MPI, OpenMP, enroot, Docker, git

PROJECTS AND TECHNICAL REPORTS

- [On Neutron Star Pulsars and Polarization](#) (year-long capstone thesis), Advisor - Dipankar Bhattacharya
- Fishbone-Moncrief Simulation for EinsteinToolkit Gallery, Advisor - Roland Haas (performed during ICERM-NRCSS22 Hackathon)
- [comp-phys-tools: Repository of Scientific Computing Tools for Physics Problems](#) Advisors - N/A
- [A Learner's Map of Numerical Relativity](#), (Published in *Ashoka Physics Journal* 2023)
- [White Hole Analogs in Circular Hydraulic Jumps](#) Advisor - Pramoda Kumar
- [Novel Framework for Consistency and Completeness Using Multiway Isomorphism](#) Advisor(s) - S. Wolfram, J. Boyd, N. Murzin
- [Quantum Mechanics on Python: Investigating Fun\(ky\) Phenomena](#) Advisor - Bikram Phookun
- [Motivating a Formalism for Phenomenologically Distinct Present](#) Advisor - Thomas 'Raja' Rosanhagen
- [Tolman-Ehrenfest Effect in Reissner-Nordström Geometries](#) Advisor - Vikram Vyas
- [Black-Hole Behavior in CMBR Bath: An Exploration using Thermodynamics](#) Advisor - Vikram Vyas
- [Least Squares Estimation through QR Factorization using Givens Rotation](#) Advisor - Hari Hablani

TEACHING EXPERIENCE

- Teaching Assistant for Prof. Dipankar Bhattacharya, *Observing the Cosmos* (Ashoka University, Spring 2023)
- Teaching Assistant for Prof. Sushmita Saha, *Lab 2: Classical Mechanics and Electromagnetism* (Ashoka University, Monsoon 2022)
- Teaching Assistant for Prof. Somak Raychaudhury, *Measuring the Universe* (AshokaX, Summer 2022)
- Teaching Assistant for Prof. Somak Raychaudhury, *Future of the Universe* (AshokaX, Winter 2021)

HONORS

- Bonn-Cologne Graduate Scholarship, University of Bonn 2023, to study astrophysics at Bonn-Cologne Graduate School
- First Prize, St. Stephen's College (Delhi University) 2023, Meera Memorial Paper Presentation Competition
- Academic Excellence Award, Ashoka University 2022, for 'excellence in Physics Major Programme'
- All-Round Philosophical Excellence, Department of Philosophy, Ashoka University 2022
- Featured Contributor, Research Project selected as a 'Staff Pick' by Wolfram Community
- Best Paper Award, *SpacSec International Conference on Cyber Warfare, Security and Space Research*, December 2021
- Travel Grant, Ashoka University, for presenting my research at International Astronautical Congress 2021
- Dean's List (all semesters), Ashoka University, for 'a superior level of academic performance'
- 1974 Batch Outstanding Student Scholarship, St Paul School 2017, in recognition of exceptional leadership
- Gold Medallist, Aryabhat Astronomy Olympiad, for years 2015, 2016 and 2017

RECENT LECTURES, OUTREACH TALKS AND POSTERS

- 'Experiments in Undergraduate Astronomy Education at Ashoka (Poster)', *Annual ASI Conference* at IIT-Indore, March 2023
- '[Neutron Star Pulsars and Polarization](#) (Poster)', *Ashoka Science Festival* at Ashoka University, October 2022
- 'Novel Framework for Consistency and Completeness Using Multiway Isomorphisms', *Wolfram Physics Colloquium*, February 2022
- '[Thermodynamics Near Black-Holes](#)', *Naxxatra Guest Lectures*, June 2021
- 'Astrodynamics and Maneuvering in Space', *Equinox Winter School*, October 2020
- 'A Tourist's Guide to Philosophy of Science', *Equinox Winter School*, October 2020
- '[Compartmental Epidemiology and Matplotlib](#)', *Naxxatra Guest Lectures*, May 2020
- 'So, What is Rocket Science', *Ashoka University*, February 2020

WINTER AND SUMMER SCHOOLS

- Zwicky Transient Facility Summer School, *ZTF (Caltech)* and *University of Minnesota*, 2023 (~50 students selected worldwide)
- Magnetohydrodynamics and HPC Workshop, *Indian Institute of Science (IISc)*, 2023 (~40 students selected in India)
- Numerical Relativity Community Summer School, *ICERM, Brown University*, 2022
- Winter School, *Wolfram Physics Project Batch of 2022* (~25 students selected world-wide)
- Summer School, *Indian Institute of Astrophysics, Batch of 2021* (~40 students selected in India)
- AstroWin Winter School on Computational Astrophysics and Machine Learning, *BM Birla Science Center*, 2020

POSITIONS OF RESPONSIBILITIES

Ashoka Research and Development Office

Student Research Coordinator

University Office

2022

- Responsible for effective collection and organization of all data on student research from Physics, Philosophy and CS departments
- Contributed towards the launch of Ashoka's first Research Magazine which showcased university's annual research output

Ashoka Physics Society

President (interim Astronomy Head)

Student Organization

2020-2021

- Designed a 3-Day workshop on Integrated Space Mission Design and programmed interactive teaching aids on jupyter notebooks
- Envisioned and facilitated the creation of student led summer research groups on campus and 'Internship Diaries' program

Muniversiti

Director Training

Educational Venture

2018-2020

- Member of early leadership team, designed holistic education modules for a start-up working with 100+ high-schools across India
- Served as the Secretary General while organizing Indore World Summit 2019, one of central India's largest Education Conferences

ACADEMIC AFFILIATIONS

Student Member *German Physical Society (DPG)*, 2024 - On-going

Student Member *Astronomical Society of India*, 2023 - On-going

Member *International Society for Studies of Time*, 2023-2024

Reviewer (Computational Physics, Philosophy) *CrossThink*, Ashoka Student Journal for Computer Science (2022-2023)

Elected Student Representative Physics Department, Ashoka University (2022-2023)

Research Affiliate Wolfram Physics Project, Wolfram Institute (2022-2023)

Elected Committee Member Computational Physics Group, Institute of Physics, United Kingdom (2020-2021)