

KARTIK TIWARI

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EDUCATION

- Postgraduate Diploma in Advanced Studies and Research (Advanced Physics Major): | **Ashoka University** (Delhi-NCR) 2023
- B.Sc. Physics (Hons) with Philosophy Minor: GPA 3.85/4.00 (*Magna cum Laude*) | **Ashoka University** (Delhi-NCR) 2022
- High School STEM Diploma, SSE (CBSE): 9.4/10 CGPA; AISCE (CBSE): 82.4 % | **St. Paul's H. S. School** (Indore) 2019

FORMAL RESEARCH EXPERIENCE

Capstone Thesis Research - Department of Physics, Ashoka University

Supervisor - **Prof. Dipankar Bhattacharya**

Ongoing - Fourth Year

- Simulating and predicting features of polarization data to be expected in observations of neutron star radiation
- Primarily computational astrophysics research on the intersection of gravitational lensing and radiative transport physics

Hydrodynamics Lab - Ashoka University

Supervisor - **Prof. Pramoda Kumar**

Spring 2022 - Third Year

- 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 - Third Year

- 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 foliations functions of Causal Graphs

Department of Philosophy, Ashoka University

Supervisor - **Prof. Thomas Rosanahagen**

Spring 2021 - Second Year

- Completed an Independent Study Module on Advanced Logic and engaged with challenging problems in Modal and Meta Logic
- Proposed a formalism to introduce 'phenomenologically distinct present' as an operator in relativistic temporal logic systems

Indian Space Research Organization - Space Applications Center and IIT, Indore

Supervisor - **Prof. Hari Hablani**

Summer 2020 - First Year

- 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 - First Year

- 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 - Second Year

- Attempted writing 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 - Third Year

- Performing 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 PROCEEDINGS

- Tiwari, K. (accepted - 2023), *Motivating Phenomenologically Distinct Present in Relativistic Temporal Logic*, Proceedings of the 18th Triennial ISST Conference, 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. (2022) *Gravity in Undergraduate Thermal Physics Courses*, Physics Education, IAPT (ISSN: 0970-5953)
- 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)
- Tiwari, K. (2021) *Inevitability of Complete Knowledge in Kuhnian Framework of Science*, 6th De La Salle University Undergraduate Philosophy Conference (Online), Philippines

TECHNICAL PROFICIENCY

- **Languages:** Python, Julia, C/C++, MATLAB, Wolfram Language, HTML, CSS, JavaScript
- **Modelling Tools and Libraries:** EinsteinToolkit, athena++, PLUTO, GADGET, AGI-STK, 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

- Fishbone-Moncrief Simulation for EinsteinToolkit Gallery, Advisor - Roland Haas (developed during ICERM-NRCSS22 Hackathon)
- [A Learner's Map of Numerical Relativity](#), Advisor - N/A
- [comp-physics-tools: Repository of Scientific Computing Tools for Physics Problems](#) Advisors - N/A
- [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 - Upcoming)
- 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

- 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 OUTREACH LECTURES AND INVITED TALKS

- 'Modelling Pulse Profiles of Neutron Star Polarization', *Quarter-Point Talk* 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

- Numerical Relativity Community Summer School, [ICERM, Brown University](#), 2022
- Winter School, [Wolfram Physics Project Batch of 2022](#) (1 amongst ~ 15 students worldwide)
- Summer School, [Indian Institute of Astrophysics, Batch of 2021](#) (1 amongst ~ 40 students country-wide)
- 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-now

- 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 (formerly 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

VOLUNTARY ACADEMIC AFFILIATIONS

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

Elected Student Representative Physics Department, Ashoka University

Research Affiliate Wolfram Physics Project, Wolfram Institute

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