

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

RESEARCH EXPERIENCE

Hydrodynamics Lab - Ashoka University

Supervisor - **Prof. Pramoda Kumar**

Spring 2021 - Third Year

- Experimentally probed White-Hole signatures in Circular Hydraulic Jumps as an independent study module on Analog Gravity
- Designed and assembled the experimental set-up and studied the relationship between riplons and Schwarzschild geometry

Shape Dynamics Research Collaboration

Supervisor - **Dr. Julian Barbour**

Monsoon 2021 - Third Year

- Shape Dynamics is a Relational Theory of Gravity that is based on a different Symmetry Group than General Relativity
- Performing Numerical experiments and contributing in conceptual development of Shape Dynamics' philosophical bedrock

Wolfram Physics Project

Supervisor(s) - **Dr. Stephen Wolfram, James Boyd**

Monsoon 2021 - Third Year

- Developed a novel Completeness-Consistency framework for Axiom Systems using Subgraph Isomorphisms of Multiway Systems
- Studied correspondence between Gauge Choices in ADM Numerical Relativity formalism and foliations of Causal Graphs

Universidad Nacional Autónoma de México

Supervisor - **Prof. Miguel Alcubierre**

Summer 2021 - Second Year

- Studied 3+1 decomposition within ADM formalism, Gauge choices for foliating spacetime and advanced numerical techniques
- Attempted simulating dynamical evolution of Schwarzschild by solving highly non-linear strongly coupled PDEs in GR

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

Supervisor - **Prof. Hari Hablani**

Spring 2021 - Second Year

- Studied Multipath Error computationally for ISRO's NavIC frequencies and compared simulations with empirical measurements
- Drafted majority of the project report that yielded a conference proceeding with Best Paper Award and a forthcoming publication

Department of Philosophy, Ashoka University

Supervisor - **Prof. Thomas Rosanhangen**

Spring 2021 - Second Year

- Completed an Independent Study Module on Advanced Logic and engaged with challenging problems in Modal and Meta Logic
- Proposed a novel method for 'Motivating a Formalism for Phenomenologically Distinct Present' in Temporal Logics

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

PUBLICATIONS AND CONFERENCE PROCEEDINGS

- 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) (forthcoming)
- Tiwari, K. (2022) *Gravity in Undergraduate Thermal Physics Courses*, Physics Education, IAPT (ISSN: 0970-5953) (forthcoming)
- 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
- Tiwari, K. (2021) *Inevitability of Complete Knowledge in Kuhnian Framework of Science*, 6th De La Salle University Undergraduate Philosophy Conference (Online), Philippines

PROJECTS AND TECHNICAL REPORTS

- *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 - B. Phookun
- *Motivating a Formalism for Phenomenologically Distinct Present* Advisor - T. Rosanhangen
- *Tolman-Ehrenfest Effect in Reissner-Nordström Geometries* Advisor - V. Vyas
- *Black-Hole Behavior in CMBR Bath: An Exploration Using Thermodynamics* Advisor - V. Vyas
- *Least Squares Estimation through QR Factorization using Givens Rotation* Advisor - H. Hablani

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

- 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 (Thrice), Aryabhat Astronomy Olympiad, for years 2015, 2016 and 2017

RECENT OUTREACH LECTURES AND INVITED TALKS

- '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

TECHNICAL PROFICIENCY

- **Languages:** Python (NumPy, SymPy, Matplotlib, Poliastro, EinsteinPy, Pandas, AstroPy, etc), Wolfram Language, MATLAB, Julia
- **Modelling Tools:** Mathematica, AGI Systems Toolkit, MATLAB Simulink, TensorFlow Keras

WINTER AND SUMMER SCHOOLS

- 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

- 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

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

Muniversiti

Director Training

Educational Venture

- Education based start-up currently working with 120+ schools, 35,000+ students and 21 NGO partners in central India
- Organized Central India's largest Education Conference as the Secretary General of Indore World Summit

ACADEMIC AFFILIATIONS

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

Junior Research Affiliate *Wolfram Physics Project*

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