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Abinash Das

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Education

Georgia Institute of Technology, Atlanta, GA

Fall 2024 – Present

Doctor of Philosophy, Physics (in progress)

- Co-advisors: David R. Ballantyne and Tamara Bogdanović (Summer 2026 – Present)
- Research focus: radio emission and detectability of dual active galactic nuclei

Master of Science, Physics (non-thesis option)

Summer 2025

- Completed during doctoral study; M.S. major GPA 3.80/4.00

University of Arizona, Tucson, AZ

August 2020 – May 2024

Bachelor of Science, Physics and Astronomy

May 2024

Professional Affiliations

Center for Relativistic Astrophysics (CRA), Georgia Tech

Summer 2026 – Present

School of Physics, Georgia Tech

Fall 2024 – Present

Honors, Scholarships, and Awards

Global Wildcat Scholarship, University of Arizona

- \$100,000 over four years

Academic Year Academic Distinction, University of Arizona

2022

Dean's List, University of Arizona

Spring 2021; Spring 2022

Dean's List with Distinction, University of Arizona

Fall 2021

Research Experience

Radio Modeling of Dual Active Galactic Nuclei

Summer 2026 – Present

Graduate Researcher, Center for Relativistic Astrophysics, Georgia Tech

Advisors: David R. Ballantyne (PI) and Tamara Bogdanović (Co-PI)

Funding: NSF AST-2407658, “The Population and Evolution of Dual AGNs at Radio Wavelengths: Predictions for the ngVLA” (\$523,083; September 2024 – August 2027)

- Develop a theoretical and computational framework for predicting radio emission from dual active galactic nuclei (AGNs) in post-merger galaxies, with applications to searches for supermassive black hole (SMBH) pairs
- Connect host-galaxy and SMBH properties from IllustrisTNG with pre-existing orbital-evolution calculations to model the evolving accretion and radio-emission properties of the pair
- Model accretion from magnetized gas and relativistic jet power, considering the dependence on the black holes' motion and the surrounding galactic environment
- Calculate radio synchrotron spectra, including synchrotron self-absorption, to predict the fluxes and spectral properties of the two AGN cores
- Investigate how radio detectability depends on projected separation, redshift, host-galaxy properties, and observing frequency, toward predictions for next-generation Very Large Array (ngVLA) surveys

Ultrafast Optics and Pulse Characterization

May 2025 – May 2026

Graduate Researcher, School of Physics, Georgia Tech

Advisor: Rick Trebino

- Co-wrote the peer-reviewed paper on quantitative characterization of ultrashort pulse-shape instability using two-dimensional runs analysis of second-harmonic-generation frequency-resolved optical gating (SHG FROG) traces
- Wrote and implemented the computational code for computing runs in the differences between measured and retrieved FROG traces, used for the statistical characterization of pulse-train instability
- Worked on the mathematical and analytical proofs in the paper, including Appendix A on the invariance of the weighted runs statistic under time–bandwidth-preserving rescaling

Arizona Cosmology Lab, University of Arizona

April 2022 – January 2024

Undergraduate Researcher

Advisor: Tim Eifler

- Investigated intrinsic galaxy alignments using the tidal alignment and tidal torquing (TATT) model in the context of weak gravitational lensing
- Implemented algorithms to generate synthetic data for predictions of Large Synoptic Survey Telescope (LSST) observations
- Examined model parameters through statistical analysis and visualization, assessing their effects on cosmic shear and galaxy–galaxy lensing signals

Theoretical Cosmology, University of Arizona

September 2023 – January 2024

Undergraduate Researcher

Advisor: Fulvio Melia

- Investigated the use of gamma-ray bursts as standard candles for extending the Hubble diagram beyond the redshift range accessible to conventional distance indicators
- Incorporated the Platinum and LGRB95 gamma-ray-burst data sets into the analysis

Asteroids Laboratory, University of Arizona

June – July 2021

Summer Researcher

Advisor: Jekan Thanga

- Developed a CubeSat mission concept targeting the atmosphere of Venus, including instrument selection and mission-feasibility assessment
- Designed a hybrid power-system concept for a proposed scientific base on Deimos, considering energy supply for an extraterrestrial environment

Publications

Published Journal Articles

1. P. Abdolghader, R. Jafari, **A. Das**, B. Banerjee, E. P. Duchrist Crews, & R. Trebino. “Quantitative Pulse-Shape-Instability Analysis Using 2D-Runs FROG.” *Optics* **7**(3), 42, 2026. [[doi:10.3390/opt7030042](https://doi.org/10.3390/opt7030042)]

Presentations

Internship Symposium Presentations

1. **A. Das**. “Academia to Industry, My Journey as an Intern at Delta Thermal Inc.” *TIMESTEP Summer Tech Internship Symposium, Arizona Space Institute, University of Arizona*, September 2023.

Course Presentations

4. **A. Das.** “Rotational Properties of 21 Sc Galaxies with a Large Range of Luminosities and Radii, from NGC 4605 ($R = 4$ kpc) to UGC 2885 ($R = 122$ kpc).” Seminal-paper presentation on the work of V. C. Rubin, W. K. Ford, Jr., & N. Thonnard (1980). *PHYS 7127: Cosmology and Galaxies, Georgia Institute of Technology*, Fall 2025.
3. **A. Das.** “The 1999 Odisha Tropical Cyclone.” *ATMO 436A, University of Arizona*, May 2023.
2. **A. Das.** “Synchrotron Radiation: Insights into Cosmic Phenomena.” *ASTR 300B, University of Arizona*, May 2023.
1. **A. Das.** “Investigating the Eclipsing Binary GALEX J19444+5459.” *ASTR 302 Final Project Presentation, Steward Observatory, University of Arizona*, December 2022.

Teaching Experience

Graduate Teaching Assistant (GTA), Georgia Tech

Spring 2025 – Summer 2026

PHYS 2212: Principles of Physics II

Spring 2025; Summer 2025; Fall 2025; Summer 2026

- Supported laboratory instruction in introductory electricity and magnetism, helping students carry out experiments and connect their observations to physical principles
- Facilitated collaborative group problem-solving sessions, guiding students through conceptual reasoning, mathematical setup, and quantitative solutions
- Proctored and graded course examinations

PHYS 3208: Modern Optics Laboratory, Dr. Colin Parker

Spring 2026

- Provided hands-on assistance with experimental setup, optical measurements, and laboratory procedures in geometrical and wave optics
- Guided students through experiments on reflection and refraction, imaging, polarization, diffraction, and interferometry
- Graded laboratory reports, evaluating experimental methods, quantitative data analysis, interpretation of results, and scientific communication

Subject Tutor, CATS Academics, University of Arizona

August – October 2022

Academic Support for Student-Athletes

- Tutored college algebra, Calculus I and II, and introductory mechanics; monitored student progress and coordinated with academic support staff to address learning needs

Selected Academic Projects

Cosmological Initial Conditions: CMB Power Spectra and the Zel’dovich Approximation

Fall 2025

PHYS 7127: Cosmology & Galaxies, Georgia Tech; computational term project; Instructor: John Wise

- Used the Boltzmann solver CAMB with Planck 2018 parameters to compute CMB temperature and linear matter power spectra, located the first acoustic peak ($\ell \approx 220$) and compared its scale with the sound horizon at last scattering, and studied the effects of baryon fraction, curvature, low dark-matter density, early reionization, and massive neutrinos
- Wrote Python code to generate cosmological initial conditions at $z = 99$ in a $(20 \text{ comoving Mpc})^3$ volume on a 64^3 grid: Gaussian random density fields sampled from the CAMB matter power spectrum with FFTs, and Zel’dovich dark-matter particle displacements and velocities, for Planck 2018 and open ($\Omega_\Lambda = 0$) cosmologies

Photometric Analysis of the Eclipsing Binary GALEX J19444+5459

December 2022

ASTR 302, University of Arizona; collaborators: R. Basant and A. Olson

- Obtained V-band observations with the Kuiper 61-inch telescope and reduced the imaging data using IRAF, including noise and cosmic-ray correction and photometry

- Constructed light curves, determined the orbital period and primary and secondary eclipse depths, and estimated component radii for the brown dwarf and subdwarf B star

Numerical Solution of the Two-Dimensional Schrödinger Equation

May 2023

PHYS 305, University of Arizona

- Applied finite-difference methods and eigenvalue calculations to solve the two-dimensional Schrödinger equation for different potentials
- Analyzed energy levels and wave functions and visualized the resulting quantum states

The 1999 Odisha Tropical Cyclone

May 2023

ATMO 436A, University of Arizona; collaborator: G. Fabian

- Examined the cyclone's formation, intensity, and contributing meteorological factors, alongside its effects on human life, the environment, and agriculture
- Project report: [doi:10.13140/RG.2.2.32826.98242](https://doi.org/10.13140/RG.2.2.32826.98242)

Professional Experience

Delta Thermal Inc., Tucson, AZ

May – August 2023

Summer Intern, TIMESTEP Summer Tech Internship Program

- Developed Python tools to analyze temperatures in MLX90640 thermal-camera images and an algorithm for automated image-translation estimation
- Analyzed temperature time series from the Asarco Ray site, using AWS for data management and machine-learning methods to investigate temperature trends

Service and Outreach

Judge, 7th Annual Harrison Science & Engineering Fair

January 2025

- Evaluated high-school student research projects in a virtual fair using video presentations, project boards, and the provided judging rubric, with attention to scientific methodology and clarity of presentation

Volunteer Teacher, Jeevan Rekha Parishad, Bhubaneswar, India

- Taught students from disadvantaged backgrounds and provided preparation for Indian competitive examinations, including JEE Main and Advanced
- Developed educational plans to support students' academic development and participated in the organization's community initiatives

Selected Coursework

Physics and mathematical methods: Electromagnetism; Quantum Mechanics I and II; Statistical Mechanics I; Mathematical Methods in Physics I

Astrophysics and optics: Cosmology and Galaxies; Radiative Processes; Optics

Additional undergraduate preparation: Computational Physics; Differential Equations; Classical Mechanics; Electricity and Magnetism I and II; Stellar Structure and Evolution; Dynamics and Mechanics in Astrophysics

Technical Skills

Programming: Python, MATLAB, C++, Java

Scientific methods: numerical modeling, finite-difference methods, eigenvalue calculations, statistical analysis, time-series analysis, machine learning, photometric data reduction

Computing and research tools: high-performance computing, AWS, Git, Jupyter, IRAF, Linux, $\LaTeX$

References

Dr. David R. Ballantyne

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Ph.D. co-advisor; PI of NSF AST-2407658

Dr. Tamara Bogdanović

Professor
School of Physics, Georgia Institute of Technology, Atlanta, GA
Office: CCB 113
Email: tamarab@gatech.edu | Phone: (404) 385-0113
Ph.D. co-advisor; Co-PI of NSF AST-2407658

Dr. Rick Trebino

Professor
School of Physics, Georgia Institute of Technology, Atlanta, GA
Office: Howey Physics Building N011
Email: rt81@gatech.edu | Phone: (404) 894-1690
Research advisor, ultrafast optics and pulse characterization (May 2025 – May 2026)