Dhairya Kotecha

Email: dhairya_k@ph.iitr.ac.in
LinkedIn: https://www.linkedin.com/in/dhairya-kotecha-a3b168280/
Github: https://github.com/Dhairya-K
Website: https://dhairya-k.github.io/DhairyaKotecha.github.io/

Research Interests

My interests lie at the intersection of theoretical and observational astrophysics, with a focus on understanding extreme and energetic astrophysical environments and the physical processes that govern them. I also maintain a strong interest in stellar and planetary systems. I am eager to explore a broad range of astrophysical problems and refine my research interests.

Academic Background

2023 – 2027 **B.Tech in Engineering Physics**, Indian Institute of Technology Roorkee
CGPA: 7.16/10
Relevant Courses: Computer Programming, Mechanics and Relativity, Thermal & Statistical Physics, Data Science, Quantum Mechanics - I, Mathematical Physics, Applied Optics, Signals and Systems.

Astrophysics Projects

Aug 2025 - Present **Big Bang Nucleosynthesis and the Lithium Problem**
Supervisor: Prof. Rajdeep Chatterjee, IIT Roorkee
Studied nuclear reaction governing light-element synthesis in the early universe.
Analyzed the dependence of primordial abundances on reaction rates, cross-sections and statistical assumptions.
Investigated the role of non-extensive (Tsallis) statistics in addressing the primordial lithium discrepancy.

Dec 2025 - Jan 2026 **Galaxy Distance Determination Using TRGB Method**
Mentor: Tanishk Mohan & Aryan Kumar (Krittika Club), IIT Bombay
Performed PSF photometry on FITS data from the GROWTH-India Telescope.
Identified the TRGB cutoff for Draco Dwarf Galaxy using.
Estimated extragalactic distances and studied red giant stellar evolution.

Dec 2025 **Galactic H I Observations and Analysis**
Supervisor: Jameer Manur, IUCAA
Analyzed 21-cm neutral hydrogen emission along the Galactic plane using calibrated power spectra.
Performed multi-Gaussian fitting on velocity profiles of Galactic spiral arms.
Derived the Galactic rotation curve, providing evidence for dark matter.

Sep – Oct 2025 **Period Determination of Multi-Eclipsing Stellar Systems using Lomb–Scargle Periodogram**
Supervisor: Prof. Kaushalya Jhuria, IIT Roorkee
Performed time-series analysis of simulated and real photometric light curves.
Applied Lomb–Scargle periodograms to extract orbital periods from irregularly sampled data.
Used physical constraints to interpret ambiguous period results.

May – Aug 2024 **Analysis of Eclipsing Binaries**
Mentor: Bhavesh Rajpoot, MPIA
Studied foundational observational astronomy and various binary systems.
Analyzed photometric light curves of eclipsing binaries and explored their astrophysical interpretation.
Modeled eclipsing binaries using PHOEBE to infer system parameters with forward modeling and inverse fitting.

For a detailed description of my research interests and projects, visit my website.

Lab & Instrumentation Experience

RAWS 2025	Radio Receiver Characterization: Measured cable losses and standing-wave patterns, analyzed LNA gain linearity.
RAWS 2025	Superheterodyne Receiver Analysis: Traced signal flow through a two-stage superheterodyne receiver and verified RF-to-IF-to-baseband frequency conversion, gain, and conversion losses.
RAWS 2025	Radio Telescope Beam Characterization: Determined beam width and pointing offsets of a 4-m radio telescope using solar cross-scans and Gaussian beam fitting.

Engineering Projects

May - Jun 2024	Design of Worm Gearbox in SolidWorks
Mar - May 2024	5-DOF Robot Arm with Stereovision for real-time manipulation
Mar - May 2024	Design, Manufacturing, and Testing of Cycloidal Gearbox
Aug - Nov 2023	Obstacle Avoidance Robot

Skills

Programming	Python – (NumPy, SciPy, Pandas, Matplotlib, scikit-learn, TensorFlow, Qiskit)
Astronomy Tools	SExtractor, Astropy, PHOEBE, Photutils, Astroquery
Software	SolidWorks,Matlab
Languages	English, Hindi, Marathi, Indian Sign Language

Achievements

Dec 2025	First Place (Group), RAWS IUCAA–NCRA Quiz & Presentation
Oct 2025	Astrophotograph featured in Trinity News "Behind the Blood Moon"
Nov 2023	Silver Medal, Qiskit Fall Fest: Dead & Alive Hackathon

Workshops, Schools & Training

9 - 19 Dec 2025	Radio Astronomy Winter School, IUCAA and NCRA-TIFR Website: raws.iucaa.in/RAWS2025/welcome.jsp Radio telescopes, interferometry, Radio Galaxies and Quasars, HI & the Interstellar Medium, The Sun and the Stars, Radiative Processes, Pulsars and Radio Transients, Milky Way and Nearby Galaxies, cosmology, and multiwavelength astronomy. lectures, tutorials, and hands-on laboratory sessions, participant presentations, discussions, and Quiz. Visit to the Giant Metrewave Radio Telescope (GMRT), providing exposure to the facility and its operations in use.

Extracurricular Activities

Apr 2024-Present	Joint Secretary, Physics and Astronomy Club – IIT Roorkee
Apr - Aug 2024	Member, Robocon – IIT Roorkee

References

Prof. Rajdeep Chatterjee
Professor, Department of Physics
Indian Institute of Technology Roorkee
Email: rchatterjee@ph.iitr.ac.in
Phone: +91 1332 285698