

Bhavesh Rajpoot

Curriculum Vitae

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Education	Bachelor of Science Majors: Physics Minors: Mathematics, Chemistry Fergusson College (Autonomous), Pune, Maharashtra, India Affiliated to Savitribai Phule Pune University, India CGPA: 8.29/10.0 (Overall) 9.38/10.0 (Major - Final Year)	07/2017 - 11/2020
	Senior School Certificate (12th Grade) Sri Guru Tegh Bahadur Public School, Patiala, Punjab, India Affiliated to Central Board of Secondary Education, India CGPA: 7.9/10 (Overall)	04/2016 - 04/2017
	Secondary School Certificate (10th Grade) Sri Guru Tegh Bahadur Public School, Patiala, Punjab, India Affiliated to Central Board of Secondary Education, India CGPA: 9.2/10 (Overall)	04/2014 - 04/2015
Publications	Rajpoot, Bhavesh , et al. (2021, June 25). TCalc: Telescope-Calculator (Version 1.1.1). Zenodo. http://doi.org/10.5281/zenodo.5035311	
Research Experience	Bayesian Analysis of Eclipsing Binaries Undergraduate Research Assistant Villanova University, Villanova, PA, U.S.A Adviser: Dr. Kyle E. Conroy <ul style="list-style-type: none">• Modelling light curves (LCs) of detached Eclipsing Binaries (dEBs) using <i>ellc</i> & <i>PHOEBE</i> models as Forward Model in <i>PHOEBE</i> Python package.• Fitting the LC model to dEB data using the Forward Models that were optimized through the Nelder-Mead algorithm and sampled through the Markov Chain Monte Carlo algorithm to estimate orbital and physical parameters with their uncertainties.• Estimation of physical properties of the individual binary component using the estimated parameters.• <i>A research manuscript, based on this project's work, in development.</i>	09/2020 - Present
	Binaries: Study and Analysis Summer Research Intern Indian Institute of Technology, Bombay, India Mentor: Mr. Vedant Shenoy <ul style="list-style-type: none">• Did a detailed study on Two-Body Problem and various Binary Star Systems, especially focusing on the Stellar Eclipses' geometry and mathematics.• Created Python pipelines to model and analyze the Radial Velocity(RV) curves of Spectroscopic Binaries(SBs) in both circular and elliptical orbits using non-linear regression and χ^2 reduction.• Mined fits LC data of <i>V453 Cyg</i> & <i>LL Aqr</i> from TESS database; processed with <i>AstroPy</i>.<i>Timeseries</i> & <i>Lightkurve</i> using Sigma-Clipping technique and Box Least Squares method.	05/2020 - 08/2020

Effects of Coronal Mass Ejections on Earth's Thermosphere

08/2019 - 02/2020

Undergraduate Research Assistant

Fergusson College (Autonomous), Pune, India

BSc Thesis Adviser: Dr. Pratibha B. Mane, Dr. Raka V. Dabhade

- Conducted a detailed study on Coronal Mass Ejections (CMEs), Thermospheric Aerosols, Mie Scattering, Twilight Air Glow phenomena and its occurrence with respect to CMEs.
- Did an intensive analysis of the archived data of Aerosol No. Density (AND) and High-energy Proton Flux.
- Determined possible correlation between a CME hit and Aerosol No. Density (AND) variation from archival data plots of AND and High-energy Proton Flux.

Online Courses

Scientific Computing in Astronomy

17/04/2020 - 03/05/2020

Indian Institute of Technology, Bombay, India

- Daily tutorials on major computational topics and techniques plus daily 2-3 astronomy and astrophysics oriented assignments.
- Topics: AstroPy, CCD FITS Image Processing and Analysis, Time-Series Analysis, Web Scraping, Statistical Data Analysis, Differential Equation Solving, Object-Oriented Programming, Numerical Differentiation and Integration, Data Fitting and Root Finding.

Astronomy Schools & Workshop Attended

CodeAstro Workshop 2021

21/06/2021 - 25/06/2021

California Institute of Technology, US

- Learned fundamental software engineering skills and best anti-discriminatory practices for building sustainable open-source packages for astronomy applications.
- Gained hands-on experience with software engineering by developing a small software package from scratch
- Created and published TCalc: Telescope Calculator python package.

Radio Astronomy Winter School 2018

14/12/2018 - 24/12/2018

National Centre for Radio Astrophysics - TIFR, and

Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune, India

- Gained hands-on experience in intermediate-level Radio Astronomy and Astrophysics through daily lectures focusing on conceptual aspects and active research in the field followed by experiments focused on Radio Astronomy and Instrumentation.
- Had field visit to Giant Meter Wave Telescope (GMRT), India.
- Operated 3m and 4m Simple Radio Telescope along with the Spectracyber module to observe HI emission-line sources in group.
- Estimated Brightness Temperature and Redshift of Galactic HI sources by analyzing Spectral Flux Density data through Baseline Correction, Gaussian fitting, and χ^2 test to plot Galactic Rotation Curve of Milky Way galaxy as the final school project.

Technical Skills

Languages: Python, \LaTeX , Bash, C, Wolfram
OS: Windows, Linux
Productivity tools: Git/GitHub, Microsoft Office, Slack, Google Docs
IDEs: Jupyter, VS Code, Spyder, Pycharm, IDLE, Wolfram Mathematica
Python Tools: NumPy, SciPy, AstroPy, Corner, Emcee, RMFit
Visualization: Matplotlib, Origin
Eclipsing Binary Analysis: PHOEBE, ellc, JKTEBOP, EBAI, Lightkurve, Allesfitter

Astronomical Instrumentation	<p>Have handled and proficient in using,</p> <p>Reflectors: Celestron 130EQ-RA motor, StarTracker 150EQ, Sky-Watcher 150EQ, Sky-Watcher 8-in Dob, GSO 8-in Dob, Celestron 8 SE, Celestron CGX EQ 925 SCT</p> <p>Refractors: StarTracker 90mm AZ, Vintage 90mm Refractor – EQ (Pier)</p> <p>Eyepieces: Plössl, Kellner (4mm, 10mm, 20mm, 25mm, 40mm)</p> <p>Sensors: ZWO-ASI120MC CMOS camera, Canon 700D DSLR Camera</p> <p>Filters: Solarite Solar Filter, GSO (1.25"): #23A Light Red Filter, #80A Medium Blue Filter, Moon Filter</p> <p>Radio: 3m & 4m Dish Type Simple Radio Telescope – AZ, SpectraCyber I/II 1420 MHz Hydrogen Line Spectrometer, RTL-SDR V3 Dongle</p>	
Academic Achievements & Scholarships	<p><i>All India Rank 3 out of 3000</i></p> <p>National Entrance Exam for M.Sc. Physics, Savitribai Phule Pune University, Pune, IN</p> <p><i>Merit Topper & Scholarship</i></p> <p>Topped Merit list and achieved Merit-based academic scholarship at National Entrance Exam for M.Sc. Physics (Astrophysics), Saint Xavier's College, Mumbai, IN</p>	<p>11/2020</p> <p>10/2020</p>
Awards and Honors	<p><i>Top 30 Under 30 Young Achievers,</i></p> <p>Astronomy Influencer, Hindustan Times: 2nd Anniversary Issue</p> <p><i>International Ambassador Award for Excellent Encouragement,</i></p> <p>International Astronomy and Astrophysics Competition</p>	<p>06/2019</p> <p>06/2019</p>
Talks & Presentations	<p>Vedantu Olympiad School Vedantu (Invited)</p> <ul style="list-style-type: none"> • Pursuing Astronomy and Astrophysics in India <p>Equinox Astrophysics Program, Naxxatra Club (Invited)</p> <ul style="list-style-type: none"> • The Physics of Eclipsing Binaries • Introduction to Observational Astronomy & Astrophysics <p>Science Club, College of Engineering, Pune (Invited)</p> <ul style="list-style-type: none"> • Eclipsing Binaries: Our Winking Buddies <p>Astro Club, Fergusson College, Pune (Contributed)</p> <ul style="list-style-type: none"> • Effects of CMEs on Earth's Thermosphere • Basics of Observational Astronomy • Introduction to Asteroid Hunting 	<p>25/04/2021</p> <p>24/09/2020</p> <p>21/09/2020</p> <p>03/08/2020</p> <p>12/06/2020</p> <p>10/12/2019</p> <p>06/07/2019</p>
Posters Presented	<p>Indian Institute of Tropical Meteorology, Pune</p> <ul style="list-style-type: none"> • <i>Effects of Coronal Mass Ejections on Earth's Thermosphere,</i> National E-Symposium on "Cloud and Precipitation Processes" <p>Fergusson College, Savitribai Phule Pune University, Pune</p> <ul style="list-style-type: none"> • <i>HI 21 cm Line: Significance and Detection,</i> Frontiers in Physics-XIII • <i>Solar Phenomena,</i> Frontiers in Solar Physics, Frontiers in Physics-XI 	<p>[01/2021]</p> <p>[02/2020]</p> <p>[01/2018]</p>
Work Experience	<p><i>Teaching Assistant</i></p> <p>Curiosity Space India, Pune, Maharashtra, India</p> <p>Responsible for:</p> <ul style="list-style-type: none"> • Teaching Introductory Astronomy course to High-School students. • Creating teaching materials, presentations and hands-on experiments. 	<p>12/2020 - 03/2021</p>

Stargazing Guide **05/2019 - 08/2020**
TrekkerBugs, Pune, Maharashtra, India

- Assigned to explain the night sky, constellations, motion of stars, etc. during stargazing sessions at night treks.
- Planned and conducted Star Parties during Astronomical Events such as Meteor Showers.

Ambassador **02/2019 – 07/2020**
International Astronomy and Astrophysics Competition
Outreached astronomy through various activities to low-income community schools.

Summer Intern **05/2019 – 08/2019**
Science Popularisation Centre of IUCAA, Pune, Maharashtra, India

- Taught basic physics and astronomy to summer school students.
- Designed and compiled various DIY experiments related to Moon for the IAU's 100th anniversary celebration.

Co-Curricular Activities

PHOEBE Workshop 2021, Villanova University, Villanova, PA, US

Moderator **06/2021-06/2021**

- Moderating the virtual workshop through Slack covering UTC+5:30 timezone.
- Assigned to help participants with the queries in the modelling and fitting module of the package and tutorials.

Krittika Astronomy Club, Indian Institute of Technology, Bombay, IN

Mentor **07/2021-Present**

- Mentor of Eclipsing Binaries group at Krittika Summer Projects 2.0.
- Will be responsible to expose and guide group of students to
 1. Learn the physics of Eclipsing Binaries and model some of the exotic systems to test various astrophysical concepts in Python.
 2. Using dedicated models and bayesian techniques to analyze the time-dependent variation in the spectrophotometric data to estimate absolute parameters of component stars.
 3. Creating animations of various astrophysical phenomena associated with Eclipsing Binaries.

Moderator **12/2020-1/2021**

- Studying Electromagnetic Transients and Spectral Analysis of Gamma Ray Bursts (GRBs) using GSPec and RMFit and Python under **Dr. Disha Sawant**
- To study the Physics behind the generation of Gravitational Wave Signals from Black Hole Mergers and perform Bayesian Analysis of the signals.
- To study Electromagnetic Counterparts of Gravitational Wave sources and perform photometric analysis on the observed data.
- To moderate **Astrophysics Workshop: Gravitational Wave Analysis and Electromagnetic Transients** at annual TechFest 2020, IITB. **[17/2020-20/2020]**

Astro Club, Fergusson College, Pune, IN

Peer Advisor **06/2019 - 06/2020**

- Advising junior students with elective selection, project hunting, career guidance, CV and Statement of Purpose drafting.

- Took online sessions on *stress handling, time management, opportunity recognition, and self-exploration* for junior members during the early period of nationwide COVID-19 lockdown.
- Mentored undergraduate students for designing and presenting scientific posters.

Coordinator & Organiser

08/2018 - 03/2020

- Organized Communal Solar Eclipse watching session, Observational Astronomy Session, Star Parties and Meteor Observations, Group Discussions & Problem Solving Sessions.
- Organized and co-ordinated Frontiers in Physics XII - XIII, 2/3 - day National Student Seminar Series aimed to provide research exposure to undergraduate students.
- Celebrated IAU's 100 Hours of Astronomy; Organized hands-on Astronomy Sessions for Low-Income School Kids and Communal Night Sky Watching.

Founder, Public Outreach Department

07/2018 - 12/2019

- Organised guest lectures of various researchers in Astrophysics
- Created **website**, social media accounts and brand **logo** for club.
- Trained junior club members on mass communication, content delivery, interactive outreach, and relation building.

Volunteer

07/2017 - 07/2019

- Designed and presented posters on the topic 'Our Future in the Universe' at 'Unravelling the Cosmos,' club's 2018 Annual Poster Exhibition. **[09/2018]**
- National Science Day celebrations at IUCAA, Pune, India. **[02/2019 & 02/2018]**
- Telescope Setup & Handling ; Renovated a Vintage 15-yo 90mm Refractor – EQ (Pier).
- Presented posters on "Basics of Astronomy, Importance of Astronomy, Beginning of the Universe" at *The Omnipresent Science-What isn't Physics?* club's 2017 Annual Poster Exhibition. **[08/2017]**

Others

- Hobbies : Cooking and Baking; Trekking, Cycling, Badminton
- Languages : English (Proficient); Hindi and Punjabi (Native)