

Bhavesh Rajpoot

Curriculum Vitae

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| Education | Master of Science 03/2022 - Present |
| | Course: Physics Specialisation: Astronomy & Astrophysics Universität Heidelberg , Heidelberg, Germany GPA: 2.2/4.0 (preliminary; 1st year) |
| | Bachelor of Science 07/2017 - 11/2020 |
| | 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) Thesis Title: <i>Effects of Coronal Mass Ejections on Earth's Thermosphere</i> Adviser: Dr. Raka V. Dabhade , Dr. Pratibha B. Mane |
| | Senior & Secondary School Certificate 04/2014 - 04/2017 |
| | Sri Guru Tegh Bahadur Public School , Patiala, Punjab, India CGPA: 7.9/10 (12th grade) 9.2/10 (10th Grade) |
| Research Experience | Major Projects: |
| | Tracing the evolution of Cosmic Noon galaxies with JWST 05/2023-Present |
| | Master Thesis Student Max Planck Institute for Astronomy , Heidelberg, Germany Adviser: Dr. Leindert Boogaard & Dr. Fabian Walter <ul style="list-style-type: none">Tracing the inside-out growth, redshift evolution in the stellar mass surface density and dust attenuation in star-forming galaxies at redshift 0.5-2.5 using spatially resolved $H\alpha$ and $H\beta$ maps measured from JWST's NIRISS slitless spectroscopy on GOODS-S field acquired from the NGDEEP survey.Re-reduced the data with an updated version of JWST Science Calibration Pipeline. |
| Testing the FCU for ELT's MICADO in NIR 08/2022-08/2023 | |
| | Research Assistant Max Planck Institute for Astronomy , Heidelberg, Germany Adviser: Dr. Robert J. Harris & Dr. Jörg-Uwe Pott <ul style="list-style-type: none">Tested the Flat-field and wavelength Calibration Unit (FCU) prototype for ELT's Multi-AO Imaging Camera for Deep Observations (MICADO) in the wavelength range of $0.7 - 2.4\mu m$ to assess if the design meets the quality criterion for calibrations.Simulated the Global Uniformity pattern for different designs in different configurations and compared them with the test results to constrain defects and other factors affecting the uniformity and, therefore, calibration quality.Gained invaluable experience in working at the optics lab with two different Near-IR cameras and other instruments.Summarised results in a detailed technical report for the MICADO team at MPIA and, based on the test results, prepared a testing plan for the final FCU hardware. |

Bayesian Analysis of Eclipsing Binaries using PHOEBE

09/2020 - 10/2021

Undergraduate Research Assistant
Villanova University, Villanova, PA, U.S.A
Adviser: Dr. Kyle E. Conroy

- Tested Inverse Problem solver suite of the *PHOEBE* eclipsing binary (EB) code with photometric time-series data from Kepler and TESS and compared its efficiency and accuracy to reproduce the published results done previously using other model fitting codes such as *jktebop*, *ellc*.
- Tested the then in-development functionalities of the code and provided feedback on model caveats through statistical analysis of discrepancies in the fitted parameters given by various models such as *ellc*, *jktebop*, *EBAI* & *PHOEBE* to help in the development of the *PHOEBE* code.
- Gained extensive experience in Python programming, model optimization and Bayesian sampling.
- Gave talks on the project and later mentored a small group during [Krittika Summer Projects 2.0](#) to use *PHOEBE* and solve inverse problems.

Minor Projects:

KOOL Project

05/2023-Present

Research Assistant
Universität Stuttgart, Stuttgart, Germany
Adviser: Pascal Jaufmann, MSc. & Dr. Jörg-Uwe Pott

- Assisting in the development of controlled Adaptive Optics tests for wind-induced image magnification stabilisation for the Extremely Large Telescope.

Morphological Analysis of CEERS' MIRI pointings in comparison to 3D-HST's AEGIS field

08/2022 - 05/2023

Research Assistant
Max Planck Institute for Astronomy, Heidelberg, Germany
Adviser: Dr. Leindert Boogaard & Dr. Fabian Walter

- Gained experience in performing Aperture Photometry on JWST's Mid-Infrared Instrument (MIRI) photometric data taken from CEERS survey using *sep* python package and extracted morphological parameters of the cosmic noon galaxies using *PetroFit* python package.

Binaries: Study and Analysis

05/2020 - 08/2020

Summer Research Student
Indian Institute of Technology, Bombay, India
Mentor: Mr. Vedant Shenoy

- Gained experience in solving the Two-Body Problem and various Binary Star Systems, especially focusing on the Stellar Eclipses' geometry and mathematics, using Python & C++-based integrators.
- 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.

Teaching Experience

Graduate Teaching Assistant
LSW, Universität Heidelberg, Germany

09/2023 - Present

- Responsible for teaching graduate students how to successfully operate a 0.7cm class telescope for taking astronomical observations.

Teaching Assistant
Curiosity Space India, Pune, India

12/2020 - 03/2021

- Responsible for Teaching Introductory Astronomy courses to high school students.

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| Work Experience | <p><i>Student Assistant</i> 03/2022-03/2023 House of Astronomy, Max Plank Institute for Astronomy, Heidelberg, Germany 4 hrs/week</p> <ul style="list-style-type: none"> Assistant to 4 public outreach projects with the task of media collection for the glossary, creating a member video for the IAU meeting, serving as a reviewer for the IAU Astrophotography competition and compiling lecture notes into a book. <p><i>Honorary Fellow</i> 10/2021 - 01/2022 Varahmihir Astronomical Observatory, MPCST, Ujjain, M.P., India 40 hrs/week</p> <ul style="list-style-type: none"> Renovated a 0.5 class telescope system and upgraded it with remote observing functionality. Performed monthly site and instrument characterisation studies and variable star studies and assisted Guest Observers with observations and technical assistance. <p><i>Ambassador</i> 02/2019 – 07/2020 International Astronomy and Astrophysics Competition 20 hrs/week</p> <ul style="list-style-type: none"> Outreached astronomy through talks to low-income community schools and inspired students to take part in the competition. <p><i>Summer Intern</i> 05/2019 – 08/2019 Science Popularisation Centre of IUCAA, Pune, Maharashtra, India 40hrs/week</p> <ul style="list-style-type: none"> Taught high-school level astronomy to 15 summer school students and also compiled various DIY experiments related to the Moon for the IAU's 100th-anniversary celebration. |
| Awards & Scholarships | <ul style="list-style-type: none"> <i>Tuition Fee Waiver based on Special Talent</i> (\$6.5k) 11/2021 Universität Heidelberg, Germany <i>Honorary Fellowship</i> 11/2021 Varahmihir Astronomical Observatory, MPCST, Bhopal, IN <i>All India Rank 3 out of 3000</i> 11/2020 National Entrance Exam for M.Sc. Physics, Savitiribai Phule Pune University, Pune, IN <i>Merit Topper & Scholarship (declined)</i> 10/2020 Topped the merit list and achieved academic scholarship at National Entrance Exam for M.Sc. Physics (Astrophysics), Saint Xavier's College, Mumbai, IN <i>Top 30 Under 30 Young Achievers</i> 06/2019 Astronomy Influencer, Hindustan Times: 2nd Anniversary Issue, Pune, IN <i>International Ambassador Award for Excellent Encouragement</i> 06/2019 International Astronomy and Astrophysics Competition, Pune, IN |
| Astronomy Schools & Workshop Attended | <p>IMPRS Summer School 4-8/09/2023 Max Planck Institut für Astronomie, Heidelberg, Germany</p> <ul style="list-style-type: none"> Gained hands-on sessions on reducing and analysing JWST photometric and spectroscopic data, from various instruments, of galaxies spanning from low to high-z universe. <p>ESO ORP Instrumentation School 17-26/05/2023 INAF-Osservatorio Astronomico di Brera, Merate, Milan, Italy</p> <ul style="list-style-type: none"> Did a Phase A study, with a group of 5 participants, on designing an Integral Field Unit spectroscope with a science case of dedicated studies on Globular Clusters, including the ability to find intermediate-mass black holes in their centres. |

Astro Hack Week workshop 17-21/10/2022
 Max Planck Institut für Astronomie, Heidelberg, Germany
 • Worked on comparing various density laws for open clusters as the hack project in a group of 5 participants, be-open repo.

CodeAstro Workshop 2021 21-25/06/2021
 California Institute of Technology, US - (remote)
 • Gained hands-on experience with software engineering and developed TCalc: Telescope Calculator python package. TCalc: Telescope-Calculator (Version 1.1.1). Zenodo. <http://doi.org/10.5281/zenodo.5035311>

Scientific Computing in Astronomy 17/04/2020 – 03/05/2020
 Indian Institute of Technology, Bombay, India - (remote)
 • Daily tutorials on major computational topics and techniques plus daily 2-3 astronomy and astrophysics-oriented assignments.
 • Served as a pre-selection round for the *Binaries: Study and Analysis* project.

Radio Astronomy Winter School 2018 14-24/12/2018
 National Centre for Radio Astrophysics - TIFR, and
 Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune, India
 • Operated 3m & 4m class Radio Telescopes along with the Spectracyber module to observe Galactic HI emission-line sources for estimating their Brightness Temperature and Redshift.

**Talks,
& Posters**

Astro Podcast: Exploring the Universe 08/10/2021 - 16/12/2021
Knowform LLP, Pune, IN

Pursuing Astronomy and Astrophysics in India 25/04/2021
Vedantu Olympiad School | Vedantu, IN

The Physics of Eclipsing Binaries 24/09/2020
Equinox Astrophysics Program, Naxxatra Club, Bengaluru, IN

Introduction to Observational Astronomy & Astrophysics 21/09/2020
Equinox Astrophysics Program, Naxxatra Club, Bengaluru, IN

Eclipsing Binaries: Our Winking Buddies 03/08/2020
Science Club, College of Engineering, Pune, IN

Effects of Coronal Mass Ejections on Earth's Thermosphere 12/06/2020
Astro Club, Fergusson College, Pune, IN

Effects of Coronal Mass Ejections on Earth's Thermosphere [Poster] [01/2021]
National E-Symposium on "Cloud and Precipitation Processes"
Indian Institute of Tropical Meteorology, Pune, IN

HI 21 cm Line: Significance and Detection[Poster] [02/2020]
Frontiers in Physics-XIII Fergusson College, Pune, IN

**Technical
Skills**

Languages: Python, \LaTeX , Bash, C
 OS: MacOS, Windows, Linux
 Productivity tools: Git/GitHub, Microsoft Office, Slack, Google Docs
 IDEs: VS Code, Jupyter, Spyder, IDLE
 Python Tools: NumPy, SciPy, AstroPy, Matplotlib
 Galaxy Analysis: JWST Pipeline, sep, Grizli, GALFIT, Photutils
 Eclipsing Binary Analysis: PHOEBE, ellc, JKTEBOP, EBAI, Lightkurve, Allesfitter, Emcee
 Observatory: MaxIm DL Pro Suite, The SkyX Pro, TPoint, N.I.N.A, ImagePlus, ASCOM

Outreach & Volunteering

Krittika Astronomy Club, Indian Institute of Technology, Bombay, IN - (Remote)

Mentor

07/2021-10/2021

- Mentored the Eclipsing Binaries group at the [Krittika Summer Projects 2.0](#).
- Responsible for exposing and guiding mentees to learn the physics of Eclipsing Binaries and to analyze the time-dependent variation in the Spectrophotometric data from TESS to estimate the absolute parameters of component stars using dedicated physical eclipsing binaries models and Bayesian techniques.

Moderator

17/2020-20/2020

- To moderate [Astrophysics Workshop: Gravitational Wave Analysis and Electromagnetic Transients](#) at annual TechFest 2020, IITB.

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.

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 and established a website, social media accounts and brand logo for the club.

Volunteer

07/2017 - 07/2019

- Gave talks on '[Basics of Observational Astronomy](#)' [10/12/2019] and 'Introduction to Asteroid Hunting' [06/07/2019].
- Designed and presented posters on the topic '[Our Future in the Universe](#)' at club's 2018 Annual Poster Exhibition, '[Unravelling the Cosmos](#)'. [09/2018]
- Volunteered for National Science Day celebrations at IUCAA, Pune, India and presented exhibits to an average of +8k people, [at 0:18 min](#). [02/2019 & 02/2018]
- Renovated a Vintage 15-yo 90mm Refractor – EQ (Pier).

Others

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