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: 1.6 (preliminary) *[Best possible grade: 1.0]*

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: (i) 8.29 (Overall) (ii) 9.38 (Major - Final Year) *[Best possible grade: 10.0]*

Thesis Title: *Effects of Coronal Mass Ejections on Earth's Thermosphere*
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: (i) 7.9 (12th grade) (ii) 9.2 (10th Grade) *[Best possible grade: 10.0]*

Research Experience

Major Projects:

Spatially resolving star-formation in galaxies at Cosmic Noon with JWST NIRISS **05/2023 - Present**

Master Thesis Student
Max Planck Institute for Astronomy, Heidelberg, Germany
Adviser: Dr. Leindert Boogaard & Dr. Fabian Walter

- Tracing the inside-out growth, redshift evolution in the stellar mass surface density and dust attenuation in star-forming galaxies at $0.5 \leq z \leq 2.5$ using spatially resolved Hα and Hβ maps measured from JWST's NIRISS slitless spectroscopy on GOODS-S field acquired from the MIRI GTO Program and the NGDEEP survey.
- *Results are planned to be published by the end of the project.*

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

- 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.
- Summarised results in a detailed technical report for the MICADO team and, based on the test results, prepared a testing plan for the final FCU hardware. Also, gained experience in working at the optics lab with two different Near-IR cameras and other instruments.

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 of students during Krittika Summer Projects 2.0 to use PHOEBE and solve inverse problems.

Minor Projects:

Königstuhl Observatory Opto-mechatronics Laboratory (KOOL) **05/2023 - Present**

Research Assistant
Max Planck Institute for Astronomy, Heidelberg & Universität Stuttgart, Stuttgart, Germany
Adviser: Pascal Jaufmann, MSc. & Dr. Jörg-Uwe Pott

- Assisting in the development of controlled adaptive optics (AO) tests for wind-induced image magnification stabilisation for the Extremely Large Telescope at the KOOL testbed at MPIA and documenting operation manuals of testbed instruments such as Spatial Light Modulator.

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 **09/2023 - Present**

Königstuhl State Observatory (LSW), Universität Heidelberg, Germany

- Taught M.Sc. and PhD students how to operate a 0.7m class telescope for taking astronomical observations during the Astro-Lab. Student count: 100+

Teaching Assistant **12/2020 - 03/2021**

Curiosity Space India, Pune, India

- Taught introductory astronomy courses to high school students. Student count: 80

Work Experience

Student Assistant **03/2022 - 03/2023**
House of Astronomy, Max Plank Institute for Astronomy, Heidelberg, Germany
4 hrs/week

- 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.

Honorary Fellow **10/2021 - 01/2022**
Varahmihir Astronomical Observatory, MPCST, Ujjain, M.P., India
40 hrs/week

- Renovated a 0.5m 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.

Ambassador **02/2019 – 07/2020**
International Astronomy and Astrophysics Competition
20 hrs/week

- Outreached astronomy through talks to low-income community schools and inspired students to take part in the competition.

Summer Intern **05/2019 – 08/2019**
Science Popularisation Centre of IUCAA, Pune, Maharashtra, India
40hrs/week

- 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

- *Tuition Fee Waiver based on Special Talent* (€ 6k) **04/2022**
  Universität Heidelberg, Germany
- *Honorary Fellowship* **11/2021**
  Varahmihir Astronomical Observatory, MPCST, Bhopal, IN
- *All India Rank 3 out of 3000* **11/2020**
  National Entrance Exam for M.Sc. Physics, Savitiribai Phule Pune University, Pune, IN
- *Top 30 Under 30 Young Achievers* **06/2019**
  Astronomy Influencer, Hindustan Times: 2^{nd} Anniversary Issue, Pune, IN
- *International Ambassador Award for Excellent Encouragement* **06/2019**
  International Astronomy and Astrophysics Competition, Pune, IN

Astronomy Schools & Workshop Attended

NYRIA Workshop **13 - 17/11/2023**
Laboratoire d'Astrophysique de Marseille, Heidelberg, France

- Presented a talk on the results of the "Testing the FCU for ELT's MICADO in NIR" project.

IMPRS Summer School **4 - 8/09/2023**
Max Planck Institut für Astronomie, Heidelberg, Germany

- Gained hands-on experience in reducing and analysing photometric and spectroscopic data of galaxies spanning from the local to the high-z universe from various JWST instruments.

ESO ORP Instrumentation School **17 - 26/05/2023**
INAF-Osservatorio Astronomico di Brera, Merate, Milan, Italy

- 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. 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 topics along with 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.

Technical Skills

Languages:	Python, LaTeX, Bash, C
OS:	MacOS, Windows, Linux
Productivity tools:	Git/GitHub, Microsoft Office, Google Docs
IDEs:	VS Code, Jupyter, Spyder, IDLE
Scientific Python:	NumPy, AstroPy, SciPy, Matplotlib, PyTorch, Scikit-Learn, Pandas
Galaxy Analysis:	SEP, photutils, grizli, GALFIT, JWST pipeline
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

Talks & Posters

Illumination Tests of MICADO FCU **14/11/2023**
NYRIA Workshop, Laboratoire d'Astrophysique de Marseille, France

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

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.

Astro Club, Fergusson College, Pune, IN

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

- Advised junior students with elective selection, project hunting, career guidance, CV and statement of purpose drafting.

Coordinator & Organiser **08/2018 - 03/2020**

- Organized sessions on observational astronomy, star parties and meteor shower observations, & communal solar eclipse watching.
- Organized and coordinated Frontiers in Physics XII - XIII, a 2/3-day National Student Seminar Series aimed to provide research exposure to undergraduate students.

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 90mm Refractor telescope with equatorial pier mount.

Others

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