Mihir Tripathi
curriculum vitae

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Education

Tata Institute of Fundamental Research (TIFR) — Mumbai, IN
M.Sc. (Research based) in Physics with First class (fully funded) — 2018–2022
- Thesis: "A study of morphological and spectral properties of protoplanetary disks with radial substructures"
- TIFR fellowship recipient for the duration of the program

Maharaja Sayajirao University of Baroda (MSU) — Vadodara, India
B.Sc. (Hons.) in Physics with Highest Honors (fully funded) — 2015–2018
- Recipient of the MSU Merit Scholarship, awarded to the top 3 performers in the Department of Physics
- Recipient of the INSPIRE Scholarship by DST (Govt. of India) annually for all three years of the program

Research and Development Experience

Academia Sinica Institute of Astronomy and Astrophysics (ASIAA, Taiwan) — Taipei, TW
Research Assistant, under Dr. Hsi-Wei Yen (Associate research fellow) — Dec 2023
- Characterizing early-stage protoplanetary disk around class I protostar L1489 IRS using ALMA observations of CO isotopolouges.

ML4Sci - Machine Learning for Science, Google Summer of Code — Remote
Interdisciplinary researcher, Mentors: Prof. Sergei Gleyzer (CERN) and Jason Terry (UGA) — May 2023-ongoing
- Developing machine learning models to identify planets and planet forming substructures in protoplanetary disks using Convolution Neural Networks and vision transformers.
- Utilized FARGO3D hydrodynamical simulation software to obtain simulations of planet-forming protoplanetary disks, and then used RADMC3D to simulate dust continuum emission from disks.
- Applying domain adaptation and transfer learning techniques to train and test the models on real images of protoplanetary disks observed by ALMA.

Academia Sinica Institute of Astronomy and Astrophysics (ASIAA, Taiwan) — Taipei, TW
Summer research intern, Mentors: Dr. Jinshi Sai and Dr. Hsi-Wei Yen — 2023(2 months)
- Analyzed archival ALMA observations of molecular line emission and continuum emission from the embedded circumstellar disk of L1489 IRS (a class I protostar).
- Obtained temperature distribution around CO-depleted regions observed in $C^{18}O$ J=2-1 and $C^{18}O$ J=3-2 lines using LTE analysis and found evidence of temperature inversion around the depletion region which indicates possibility of CO freeze-out in the region.

Stingray software (OpenAstronomy), Google Summer of Code — Remote
Software developer, Mentors: Dr. Matteo Bachetti, Dr. Daniela Huppenkothen(SRON) — 2022(8 months)
- Developed a new module 'bexvar' with a test suite, documentation, and tutorials in Stingray to calculate and plot the Bayesian excess variance of light-curve data.
- Extended support to Stingray Lightcurve class for the addition of three new optional attributes (i.e., fractional exposure, background counts, and, background ratio) to use in lightcurve object.
- Added functionality to allow the creation of Stingray lightcurve object with uneven time sampling.

Department of Astronomy and Astrophysics, TIFR — Mumbai, IN
Research Scholar: TIFR Star-Planet Formation and Exoplanets Group under Prof. Manoj Purvankara — 2020–2022
- Studied morphological and spectral properties of protoplanetary disks with radial substructures (DSHARP disks and Spitzer identified transitional disks) imaged at high angular resolution by ALMA.
- Developed Python scripts and utilized CASA to produce deprojected and azimuthally averaged radial intensity profiles of the disks and measure properties of annular substructures from the profiles.
- Prepared SEDs (using archival photometry and *Spitzer* IRS spectra) of the DSHARP sources, transitional disk sources, and compared them with SEDs of around 250 class II YSOs from Taurus region.
- Obtained the equivalent width of Silicate features and various spectral indices to analyze and compare

the degree of dust settling, and silicate dust processing among the disk samples.

Department of Nuclear and Atomic Physics, TIFR
Research Scholar: The INdia-based TIN Detector Project (TIN.TIN)

Mumbai, IN
2019-2020

- Contributed to the development of NTD Ge temperature sensors for cryogenic bolometer TIN.TIN.
- Measured a temperature offset affecting the performance of a cryogenic bolometer mounted on the mixing chamber (MC) of a Cryogen-free Dilution Refrigerator using a Fixed-Point Device.
- Prepared NTD Ge temperature sensors from neutron irradiated Germanium wafers, estimated their Neutron fluence using a new and quick Resistance Ratio method, and obtained their Mott parameters

Advanced Physics Summer Program (REU)
Undergraduate student Intern

Ahmedabad, IN
Summer 2017

- One of the 35 students selected for the program designed to provide research experience to undergraduates.
- Designed a DIY experimental setup to investigate the effects of polarization on Young's double slit experiment.
- Awarded for being one of the top 3 performers in the program.

Teaching and Leadership Experience

National Project for Technology Enhanced Learning (NPTEL)
Subject Matter Expert - Physics

Remote
2021–2023

- Created around 50 video solutions for previous year GATE (Physics) exam questions to publish on NPTEL MOOC portal run by IITs, IISc and Ministry of Education (Government of India).

Indian Institute of Information Technology, Vadodara
External Teaching Assistant: Waves and Electromagnetics (PH 170)

Gandhinagar, IN
2022

- Taught and facilitated 30 tutorial sections to 240 students, planned lessons and activities, conducted viva, graded exam papers, designed and conducted 25 weekly laboratory sessions using PhET simulations and MATLAB.

Department of Astronomy and Astrophysics, TIFR
Teaching Assistant: Astronomy and Astrophysics I (P303.1)

Mumbai, IN
2020–2021

- Assisted in teaching 30 TIFR graduate students. Topics included: Introductory Astronomy, Stellar Astrophysics, interstellar medium and star formation, Galactic and extra-galactic astronomy.
- Formulated, supervised, and evaluated all exam papers, designed and conducted tutorials, graded assignments.

MSU SpaceX, World Space Week Association
Lead organizer: MSU SpaceX world space week celebration

Vadodara, IN
2016

- Planned and managed numerous events, supervised around 15 volunteers, gathered hundreds of participants.
- Personally organized competitions, talks, and workshops at several schools in the world space week to promote space science.

Invited talks and Outreach

Talked on 'Applications of Machine Learning in Astrophysics' at IIT-BHU
2023

Conducted public night sky observations and astronomy workshops at Andaman Islands
2023

Invited to set up a private observatory, conduct observations and outreach events for local villagers and tourists, and astronomy career guidance sessions for students at remote islands of Andaman and Nicobar.

Talked on 'GSoC 23: How to get started' at Microsoft Learn Student Community, Pune
2022

Talked on 'Advances and opportunities in Astrophysics' at ART '22, IEEE GCET
2022

Volunteer for TIFR Frontiers of Science outreach program
2018, 2019

Lead guided tours of TIFR labs and research activities for high school students from all around the nation.

Organizer of ISRO-SAC space exhibition for public at MSU
2016

Organized and conducted ISRO-SAC public exhibition on remote sensing satellites and satellites launch vehicles.

Technical Skills

Programming Languages: Proficient in: Python, C; Basic ability: Bash, FORTRAN
Astronomy software suites: FARGO3D, RADMC3D, AstroPy, CASA, CARTA, ds9, Stingray, photutils, synphot
Scientific software and libraries: MATLAB, Mathematica, Origin, NumPy, SciPy, Pandas, Scikit-learn
Others: Git and version control systems, Open-source software development, Scientific software development

Awards and Achievements

Selected as a Google Summer of Code contributor for 2 consecutive years   2022, 2023
Projects selected in open-source astronomy software and machine learning for science organizations.
Selected out of ~6000 participants around the world, received 4,500$ as stipend.

Secured All India Rank 41 in the Joint Entrance Screening Test (JEST)   2018
JEST is a national level entrance examination for admission to reputed Physics Masters and Ph.D. programs in India

Awarded Maharaja Sayajirao University Merit Scholarship   2018
Awarded by Department of Physics (MSU) for being one of the top 3 performers in 2018 Batch

Awarded 'Innovation in Science Pursuit for Inspired Research' scholarship   2015–2018
Issued by DST, Government of India to top 5% students in the country to pursue higher studies in natural sciences

References

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Dr. Matteo Bachetti
Researcher (Staff Scientist)
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