

# PREETHI R. KARPOOR

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## EDUCATION

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### University of California San Diego

MS Astronomy, GPA: 3.24/4.00

San Diego, CA

Dec 2024

### Visvesvaraya Technological University

BE Mechanical Engineering, GPA: 8.63/10.00

Bangalore, India

Aug 2020

## SELECTED RESEARCH EXPERIENCE

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### Louisiana State University

*Research Affiliate*

August 2025 - Present

- Advisor: Prof. Matthew Penny
- Building an end-to-end Roman photometry precision pipeline, to establish a quantitative framework benchmarking achievable sensitivity and precision across extraction methods and cadence scales.
- Produced noise and error budgets that quantify detection sensitivity, informing exoplanet yield forecasts and microlensing event detectability to advance Roman's time-domain readiness.

### Indian Institute of Astrophysics

*Research Associate*

Bangalore, India

July 2025 - Present

- Advisors : Dr. Arun Surya and Prof. Ravinder Banyal
- Conducting Feasibility studies for the atmospheric modeling component of observations with SCALES, an upcoming integral-field spectrograph for the Keck Telescope, focusing on the simulation and retrieval of spectral features in directly imaged planetary atmospheres.
- Delivering early science use case development and tool readiness efforts for SCALES, including pipeline development and observational strategy.

### UC San Diego

*Graduate Research Assistant*

La Jolla, CA

Sept 2022 - Dec 2024

- Advisors : Prof. Christopher Theissen and Prof. Adam Burgasser
- Built EXOSCAPER (Exoplanet Survey and Characterization Program for Earth-like Rocky Planets), a scalable, customizable, and modular end-to-end pipeline for detecting and validating exoplanet candidates from TESS photometry, integrating noise modeling, flare mitigation, and vetting tools to enhance transit detection robustness and accuracy.
- Conducting a demographic analysis of transiting exoplanets around mid-to-late M dwarfs in TESS data, deriving occurrence rates and population-level trends with improved completeness and bias correction.

### California Institute of Technology

*Postbaccalaureate Research Assistant*

Mar 2021 - Apr 2022

- Mentor: Dr. Ashish Mahabal, Astronomer (Division of Physics, Mathematics, and Astronomy) and Lead Computational & Data Scientist (Center for Data-Driven Discovery, Caltech)
- Designed and implemented Transformer-based deep-learning models, including Time-Series and Vision Transformers, to enhance the detection of subtle exoplanetary signals in TESS photometry, advancing accuracy in low-signal planet characterization.
- Analyzed transient phenomena in photopolarimetric data from the RoboPol instrument at the Skinakas Observatory, focusing on quasar polarization-plane rotations. Investigated correlations with polarization properties to improve understanding of active galactic nuclei's physical conditions and magnetic field geometries.

### Indian Institute of Science - ISRO Space Astronomy Group

*Research Assistant*

Bengaluru, India

Jan 2021 - April 2022

- Mentors: Prof. Pawan Bharadwaj (Centre for Earth Sciences - Indian Institute of Science) & Dr. Shyama Narendranath (U R Rao Satellite Centre - Indian Space Research Organization)
- Developed a machine-learning framework by adapting the SymAE autoencoder (Bharadwaj et al. 2020) to recalibrate X-ray Fluorescence (XRF) Spectroscopic data from Chandrayaan-2, India's second lunar exploration mission, optimizing for nuisance parameter mitigation and high-resolution spectral extraction and fitting.

- Enhanced the accuracy of lunar surface compositional analysis by implementing advanced computational and statistical techniques, showcasing the integration of advanced computational techniques with planetary science for efficient, data-intensive interpretations

### **CMR Institute of Technology**

*Research Assistant*

Bengaluru, India  
March 2021 - August 2021

- Mentor: Prof. Rajesh Gopal, Department of Physics, CMR Institute of Technology
- Modeled the impact of primordial tangled magnetic fields on the angular momentum evolution of protogalaxies within the framework of Tidal Torque Theory.
- Derived and assessed the contribution of magnetic fields to protogalactic spin-up using linear perturbation theory, providing insights into the interplay between magnetohydrodynamics and early galaxy formation processes.

### **Indian Space Research Organization (ISRO) HQ**

*Research Assistant*

Bengaluru, India  
Oct 2020 - Jan 2021

- Mentor: Prof. P. Sreekumar, Satish Dhawan Professor, Indian Space Research Organization HQ
- Conducted precursor science for ISRO's ExoWorld Mission by investigating the influence of photometric precision on exoplanet candidate detection and validation using Kepler and K2 datasets, focusing on optimizing observational strategies for the proposed 1.5-meter exoplanet-focused space telescope.
- Implemented single and multi-aperture photometry pipelines for Kepler/K2 full-frame image stacks to extract precise light curves and assess detection thresholds, advancing the feasibility of accurate exoplanet characterization and supporting mission design criteria.

### **Indian Space Research Organization (ISRO)-Space Astronomy Group**

*Research Assistant*

Bengaluru, India  
Aug 2020 - Oct 2020

- Mentor: Dr. Shyama Narendranath (U R Rao Satellite Centre - Indian Space Research Organization)
- Mechanical Concept and Design Development for Sample Handling Mechanisms for in-situ lunar polar exploration, optimizing structural designs for regolith and surface sample handling in extreme environments.
- Analyzed load-bearing structures and developed kinematic models for lunar rovers, ensuring motion adaptability and stability on uneven terrain in challenging lunar regions.
- Created simulation models for uneven terrain motion, contributing to the feasibility and operational efficiency of lunar rover sample collection systems.

### **Actalent (formerly EASi)**

*Engineering Intern*

Bengaluru, India  
Jan 2020 - Feb 2020

- Designed and analyzed automobile components for leading clients like Mercedes Benz, Ford, and Honeywell, ensuring precision and adherence to industry standards.
- Worked with teams in Research & Development, Analysis, and Product Delivery to streamline workflows and gain practical insights into automotive design and manufacturing processes.

### **Indian Institute of Astrophysics**

*Engineering Intern*

Bengaluru, India  
Mar 2019 - Nov 2019

- Mentor: Prof. P S Parihar, Professor, Indian Institute of Astrophysics
- Designed and optimized the Shack-Hartmann Wavefront Sensor and Faint Object Spectrograph and Camera (FOSC) for the National Large Optical Telescope (NLOT) project using SolidWorks and Zemax, focusing on precision alignment and optical performance.
- Developed and tested the Grism Wheel Assembly, ensuring seamless integration with FOSC for enhanced spectral resolution and operational reliability in low-light conditions.

### **Inter-University Centre for Astronomy and Astrophysics (IUCAA)**

*Dean's Visitor*

Pune, India  
Jan 2019 - Feb 2019

- Mentor: Prof. Joydeep Bagchi, Professor, Inter-University Centre for Astronomy and Astrophysics
- Conducted precise radio observations of 21 cm neutral hydrogen emissions from the Milky Way Galaxy using a Horn Antenna, emphasizing calibration for signal clarity and spectral accuracy.

- Processed and analyzed hydrogen line profiles to derive the Galactic rotation curve and spiral structure, employing Doppler shift measurements and kinematic modeling techniques to extract key parameters of the Milky Way's mass distribution.

## Indian Institute of Astrophysics

Engineering Intern

Bengaluru, India

Jan 2018 - Mar 2018

- Mentor: Dr. Govinda K V, Former Deputy Director, U R Rao Satellite Centre - Indian Space Research Organization
- Developed mechanical subsystem designs for the National Large Solar Telescope (NLST), including precision engineering of the Fabric Cover Assembly and Dome Cover Mechanism, ensuring structural integrity and seamless operational performance.
- Contributed to the conceptual development of retractable dome models, optimizing design configurations to enhance functionality, adaptability, and durability for advanced solar observations.

## TEACHING EXPERIENCE

### Graduate Teaching Assistant for PHYS 13: Life in the Universe (Astrobiology)

UC San Diego

Graduate Teaching Assistant

April 2023 - June 2023

- Facilitated interdisciplinary discussions on astrobiology topics, guiding 60+ students to explore planetary environments, habitability, and the potential for extraterrestrial life.
- Evaluated assignments and exams with an emphasis on integrating concepts across physics, biology, and planetary science, ensuring students connected theoretical ideas with real-world astrobiology.
- Mentored students on final projects involving habitability studies, life-detection methods, and exoplanet science, providing individualized feedback and research insights.

### Graduate Teaching Assistant for PHYS 5: Stars and Black Holes (Introductory Stellar Astrophysics)

UC San Diego

Graduate Teaching Assistant

Sept 2022 - Dec 2022

- Led weekly discussion sessions for over 200 students, breaking down complex astrophysical concepts such as stellar evolution, supernovae, and black hole formation.
- Developed targeted assessment strategies, including detailed evaluations of assignments and exams to reinforce students' understanding of core stellar and black hole physics.
- Provided one-on-one mentoring on student projects, focusing on quantitative analysis of stellar properties, mass accretion in black holes, and applications of observational data.

## OBSERVING EXPERIENCE

### Lick Observatory - KAST Optical Spectrograph

19 nights

Co-I for 2023A, 2023B, 2024A, 2024B, 2025A (PI : A.Burgasser)

### Lick Observatory - ShARCS

1 night

### NASA InfraRed Telescope Facility - SpeX

16 nights

Co-I for 2024B (PI : C.Theissen)

### Keck Observatory - NIRES

6 nights

Co-I for 2023B, 2024A, 2024B, 2025A (PI : A.Burgasser)

### Keck Observatory - NIRSPEC

4 nights

Co-I for 2024A (PI : A.Burgasser)

### Keck Observatory - LRIS

1 night

Co-I for 2024B, 2025A (PI : A.Burgasser)

## GRANTS AND FUNDING

### Developing Simulations and Real-Time Alert Systems for Rare Transiting Events: Exoplanets around Brown Dwarfs as a Case Study

Co-I, LSST-DA Science Catalyst Proposal (PI : C. Theissen), \$6,000

## A Magnitude limited Sample of M dwarfs to constrain the Super-Earth Rate across the Fully Convective Boundary

Co-I, TESS Cycle 7 Guest Investigator, (PI : C. Theissen), \$70,000

### POSTERS

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| <b>TESS Science Conference III, Massachusetts Institute of Technology</b><br><i>'Unveiling the Earth+super-Earth Occurrence Rates in Mid-to-Late M dwarfs with TESS'</i> | Boston, MA<br>July 2024            |
| <b>Cool Stars 22, UC San Diego</b><br><i>'Unveiling the Earth+super-Earth Occurrence Rates in Mid-to-Late M dwarfs with TESS'</i>  | San Diego, CA<br>June 2024         |
| <b>243rd Meeting of AAS</b><br><i>'Unveiling the Earth+super-Earth Occurrence Rates in Mid-to-Late M dwarfs via Magnitude Limited Samples with TESS'</i>                 | New Orleans, LA<br>Jan 2024        |
| <b>240th Meeting of AAS</b><br><i>'Morphological Classification of Galaxies using Vision Transformer Model'</i>  | Pasadena, CA (Virtual)<br>Jun 2022 |
| <b>238th Meeting of AAS</b><br><i>'Effect of Cosmic Magnetic Fields on Angular Momentum of Protogalaxies'</i>  | Virtual<br>June 2021               |
| <b>Modern Engineering Trends in Astronomy (META) 2018 at National Centre for Radio Astrophysics</b><br><i>'Seismic Isolation in Advanced LIGO: Current Trends'</i>       | Pune, India<br>Sept 2018           |

### TALKS AND ORAL PRESENTATIONS

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| <b>2nd Planetary Science, Informatics Data Analysis Meeting, USRA-LPI</b><br><i>'Deep Redatuning of Chandrayaan - 2 Large area Soft X-ray Spectrometer (CLASS) for Chemical Mapping of the Lunar Surface'</i> | Virtual<br>June 2021         |
| <b>SRISHTI, a State Level Technical Fest</b><br><i>'Satellite and Space Navigation using Pulsars'</i>   | Bengaluru, India<br>May 2017 |

### PUBLICATIONS

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- **Karpoor, P. R.**, Theissen, C.A, Burgasser, A. J., Christiansen, J., Hardegree-Ullman, K., Muirhead, P., Newton, E., Tamburo, P., Vanderburg, A., Winters, J., "Unveiling the Earth+super-Earth Occurrence Rates in Mid-to-Late M dwarfs with TESS", *in prep*
- S. Yalçinkaya , K. Barkaoui, et al. (**including Karpoor, P. R.**) "TOI-1743 b, TOI-5799 b, TOI-5799 c and TOI-6223 b: TESS discovery and validation of four super-Earth to Neptune-sized planets around M dwarfs", *Astrophysical Journal*, Submitted, July 2025
- Hardegree-Ullman, K., Bergsten, G. J., Christiansen, J., et al. (**including Karpoor, P. R.**) "Scaling K2: Short-Period Sub-Neptune Occurrence Rates Peak Around Early-Type M Dwarfs", *Astronomical Journal*, July 2025
- Zheng, W., Dessart, L., et al. (**including Karpoor, P. R.**) "SN 2023ixf in the Pinwheel Galaxy M101: From Shock Breakout to the Nebular Phase", *Astrophysical Journal*, June 2025
- Vasylyev, S. S., Dessart, L., et al. (**including Karpoor, P. R.**) "Spectropolarimetric Evolution of SN 2023ixf: an Asymmetric Explosion in a Confined Aspherical Circumstellar Medium", *Astrophysical Journal*, Submitted, May 2025

- Loritsch, M., Burgasser, A. J., et al. **(including Karpoor, P. R.)** "Kast Optical Spectra of Unclassified Stars Within 20 pc of the Sun", RNAAS, May 2025
- Fernandes, R. B., Bergsten, G. J., et al. **(including Karpoor, P. R.)** "Signatures of Atmospheric Mass Loss and Planet Migration in the Time Evolution of Short-Period Transiting Exoplanets", Astronomical Journal, April 2025
- Burgasser, A. J., Schneider, A. C., et al. **(including Karpoor, P. R.)** "New Cold Subdwarf Discoveries from Backyard Worlds and a Metallicity Classification System for T Subdwarfs", Astrophysical Journal, April 2025
- Ghachoui, M., Rackham, B. V., et al. **(including Karpoor, P. R.)** "TESS discovery of two super-Earths orbiting the M-dwarf stars TOI-6002 and TOI-5713 near the radius valley", Astronomy & Astrophysics, 690, A263, October 2024
- Burgasser, A. J., Gerasimov, R., et al. **(including Karpoor, P. R.)** "Discovery of a Hypervelocity L Subdwarf at the Star/Brown Dwarf Mass Limit", Astrophysical Journal Letters, 971, 1, August 2024
- Barkaoui, K., Schwarz, R. P., et al. **(including Karpoor, P. R.)** "Three short-period Earth-sized planets around M dwarfs discovered by TESS: TOI-5720 b, TOI-6008 b, and TOI-6086 b", Astronomy & Astrophysics, 687, A264, July 2024
- Rothermich, A., Faherty, J. K., et al. **(including Karpoor, P. R.)** "89 New Ultracool Dwarf Comoving Companions Identified with the Backyard Worlds: Planet 9 Citizen Science Project", Astronomical Journal, 167, 6, 253, June 2024
- Vasylyev, S. S., Yang, Y., Filippenko, A. V., et al. **(including Karpoor, P. R.)** "Early Time Spectrophotopolarimetry of the Aspherical Type II Supernova SN 2023ixf", Astrophysical Journal Letters, 955, 2, 37, October 2023.
- Jacobson-Galan, W. V., Dessart, L., Margutti, R., et al. **(including Karpoor, P. R.)** "SN 2023ixf in Messier 101: Photo-ionization of Dense, Close-in Circumstellar Material in a Nearby Type II Supernova", Astrophysical Journal Letters, 954, 2, 42, September 2023

## SERVICE AND OUTREACH

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<b>Executive Secretary for NASA Astrophysics Research &amp; Analysis (APRA) and Strategic Astrophysics Technology (SAT) Program</b> <i>NASA Headquarters, Washington DC</i>	Remote (NASA HQ) April 2025
<b>Co-Chair for Splinter Session on Exoplanet Demographics</b> <i>TESS Science Conference III at Massachusetts Institute of Technology</i>	Boston, MA July 2024
<b>Astronomy &amp; Astrophysics Communications Committee</b> <i>University of California San Diego</i>	San Diego, CA Aug 2024 - Dec 2024
<b>Member of the TESS Follow Up Program (TFOP)</b>	August 2024-Present
<b>Local Organizing Committee Member at Cool Stars 22</b> <i>University of California San Diego</i>	San Diego, CA June 2024
<b>Astronomy &amp; Astrophysics DEI Committee</b> <i>University of California San Diego</i>	San Diego, CA Aug 2023 - July 2024
<b>Talk on "Career Pathways for Mechanical Engineers"</b> <i>Department of Mechanical Engineering, CMR Institute of Technology</i>	Virtual June 2023

## **Talk on "From Engineering to Astrophysics: Navigating Pathways in STEM Careers"**

Bengaluru, India

CMR National Pre-University College

Jan 2023

## **Outreach for LIGO-India**

Bengaluru, India

Organized science education and outreach events for LIGO-India on behalf of Department of Science & Technology, Government of India

July 2019 - September 2019

## **Student Program Coordinator - Higher Education Cell, CMR Institute of Technology**

Bengaluru, India

Initiated and led events to raise student awareness on post-engineering opportunities and provided mentorship for entrance exams like GRE, GATE, GMAT, and JEST for more than 4,000 students

Aug 2018 - Aug 2019

## **Content Research and Creation, Astronomical Society of India**

Bengaluru, India

- Assisting Dr. G. Srinivasan (Apex Science Board, ISRO) in developing a 35-40 lecture series in Astronomy and Astrophysics for advanced undergraduates and Master's students, involving research, content creation, recording, editing, and preparing for publication on the Astronomical Society of India's social media.

Dec 2021 - August 2022

## **Global Ambassador for Society of Women Engineers**

Bengaluru, India

Selected for three consecutive terms as one among 100 Women to represent the Society of Women Engineers, the largest organization in the world for Women in STEM with a primary aim of advocacy for Women in STEM

July 2019 - August 2022

## **Content Creation Lead, Society of Women Engineers**

Bengaluru, India

Led a team of 25 Global Ambassadors to highlight Women in STEM news worldwide, managed social media for the Society of Women Engineers, organized inclusive STEM events with global participation, and spearheaded regional content creation by showcasing underrepresented achievers and translating content for broader reach.

July 2020 - July 2021

## **AWARDS**

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### **Astronomy Excellence Award**

University of California San Diego

March 2022

### **Valedictorian for Class of 2020, CMR Institute of Technology**

Recognized for ranking 1st among 1000+ students throughout the 4-year Undergraduate program across all discipline

Sept 2020

### **Society of Women Engineers - WE Local India Scholarship Winner**

Awarded Scholarship to attend the WE Local India Conference (India's Largest Women-in-STEM Event) and Society Membership.

March 2021

## **SKILLS**

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### **Data Analysis and Management:**

**Data Querying:** SQL, ADQL, Astroquery

**Data Visualization:** Matplotlib, Seaborn, Origin

### **Machine Learning Frameworks:**

TensorFlow, PyTorch, PySR

### **Softwares and Tools:**

AstroImageJ, SAO DS9, FITS Liberator, Git, LaTeX, MS Office, VS Code

### **Computer Programming Languages:**

Python, MATLAB, C, C++, HTML, IDL

### **Operating Systems:**

Windows, Mac OS, Linux

### **Mechanical Engineering Tools:**

CATIA, ANSYS, SolidWorks, SolidEdge, CNC Programming

## REFERENCES

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**Prof. Adam Burgasser**

*Professor*

*Department of Astronomy & Astrophysics*

*University of California San Diego*

*aburgasser@ucsd.edu*

**Prof. Christopher Theissen**

*Assistant Professor*

*Department of Astronomy & Astrophysics*

*University of California San Diego*

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**Dr. Jessie Christiansen**

*Chief Scientist*

*NASA Exoplanet Science Institute*

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