Preethi R. Karpoor

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Research Interest	I am a first-year Astronomy Graduate Student at the University of California San Diego. My research interests lie in the interdisciplinary fields of Exoplanets and Machine Learning. I am currently working on exoplanet demographics around low-mass stars. I am deeply interested in working on the development of Physics Informed Neural Networks (PINNs) and Transformer models and their adaptation to Exoplanet Science.
	A Mechanical Engineer by education, I have worked in various disciplines, from Machine Design of Telescopes to Machine Learning for Planetary Sciences, and I continue to explore.

Education	**Centre for Astrophysics and Space Sciences, UC San Diego**, *Doctor of Philosophy in Astronomy* September 2022	Present La Jolla, San Diego, CA, USA
	Visvesvaraya Technological University, *Bachelor of Engineering in Mechanical Engineering* *GPA: 8.63/10.0* *August 2016	August 2020* *Bangalore, Karnataka, India*

Research Experience / Internships	***University of California San Diego***, *Graduate Research Assistant* *September 2022	Present*

- *Mentors: Dr. Adam Burgasser, Professor, Department of Physics, and Dr. Christopher Theissen, UCSD Chancellor's Fellow*
- *Working on the habitability of exoplanets around low-mass stars using TESS data*
- *Work is focused on Building and studying deep learning models (using Vision Transformers) and pipelines to identify exoplanets using TESS light curves.*
- *Also working on observational analysis and characterization of low-mass binary star systems*

California Institute of Technology, *Intern*   *March 2021 | April 2022*

- *Mentor: Prof. Ashish Mahabal, Astronomer (Division of Physics, Mathematics, and Astronomy) and Lead Computational & Data Scientist (Center for Data-Driven Discovery, Caltech)*
- *Working on Deep Learning of TESS Exoplanet Data & RoboPol Photopolarimeter Data*
- *Built and studied deep learning models based on the Transformer architecture to identify exoplanets using TESS light curves.*
- *Analyzed features in 2D image representations of light curves of transient sources in RoboPol experimental data.*

Indian Institute of Science - ISRO Space Astronomy Group, *Research Assistant*
January 2021 | Present
Bangalore, Karnataka, India

- *Mentors: Prof. Pawan Bharadwaj (Centre for Earth Sciences - Indian Institute of Science) & Dr. Shyama Narendranath (U R Rao Satellite Centre - Indian Space Research Organization)*

- *Project: Developing Machine Learning Algorithms for generating Lunar Chemical Maps from the X-ray Fluorescence Spectrometer, CLASS, aboard Chandrayaan 2, the second Lunar Exploration Mission of the Indian Space Research Organization (ISRO).*

- *Built and trained a Deep Learning model based on a novel autoencoder "SymAE" to generate accurate synthetic XRF data for the CLASS experiment.*

- *The stated work was presented at the "5th Planetary Data Workshop and Planetary Science, Informatics & Data Analysis Meeting Organized by Lunar & Planetary Institute and Universities Space Research Association (June 2021)."*

CMR Institute of Technology, *Research Assistant*   *March 2021 | August 2021*
Bangalore, Karnataka, India

- *Mentor: Prof. Rajesh Gopal, Department of Physics, CMR Institute of Technology*

- *Project: Worked on developing models for 'Effect of Cosmic Magnetic Field on Angular Momentum of Protogalaxies'*

- *Studied the role of primordial tangled magnetic fields in sourcing and sustaining angular momentum growth of protogalaxies in the framework of tidal torque theory.*

- *Estimated the extent of contribution to protogalactic rotation in the framework of linear perturbation theory*

Indian Space Research Organization, *Intern*   *October 2020 | January 2021*
Bangalore, Karnataka, India

- *Mentor: Prof. P. Sreekumar, Satish Dhawan Professor, Indian Space Research Organization.*

- *Project: Worked on Photometric Analysis of Transiting Exoplanets.*

- *Aim of the work was to Study the Effects of Photometric Accuracy in accepting or rejecting exoplanet candidates using data from Kepler and K2 missions.*

- *Performed Single and Multi Aperture Photometry on Image Stacks to identify exoplanets from the available images.*

- *Extracted Light curves of the Exoplanets from Image Stacks available on NASA Portals and analyzed them using Astronomical Image Processing Software like AstroImageJ, SAO DS9, FITS Liberator.*

Indian Space Research Organization-Space Astronomy Group,
Intern   *August 2020 | October 2020*
Bangalore, Karnataka, India

- *Mentor: Dr. Shyama Narendranath (U R Rao Satellite Centre - Indian Space Research Organization)*

- *Project: Worked on Mechanical designs for 'Sample Handling Mechanism' for In-situ Lunar Polar Mission Exploration programs.*
- *Studied possible designs and structures for Sample Handling System for a lunar rover.*
- *Created CAD designs based on four-bar mechanisms for linear movement on an uneven surface.*

Actalent (formerly EASi), *Intern*   *January 2020 | February 2020*
Bangalore, Karnataka, India

- *Worked on Computer-Aided Designing and Analysis of Automobile parts of leading companies like Mercedes Benz, Ford, Honeywell, etc.*
- *Worked with various teams, each concerned with different facets like Research & Development, Analysis, Product Delivery, Support, etc. To gain a deep insight into the industry's functioning.*

LIGO India, *Research Volunteer*   *July 2019 | September 2019*
Bangalore, Karnataka, India

- *Primarily involved in the outreach activity for LIGO India at a Mega-science Project Exhibition by the Government of India.*

Indian Institute of Astrophysics, *Engineer Intern*   *March 2019 | November 2019*
Bangalore, Karnataka, India

- *Mentor: Prof. P S Parihar, Professor, Indian Institute of Astrophysics*
- *Mechanical Design of Shack-Hartmann Wavefront Sensor and Faint Object Spectrograph and Camera (FOSC) as a part of National Large Optical Telescope (NLOT)*
- *Contributed to the design and development of Shack-Hartmann Wavefront Sensor.*
- *Prepared designs for the Faint Object Spectrograph and Camera(FOSC) using software such as Solidworks and Zemax.*
- *Designed the Grism Wheel Assembly, which is a part of FOSC.*

Inter-University Centre for Astronomy and Astrophysics,
Dean's Visitor   *January 2019 | February 2019*
Pune, Maharashtra, India

- *Mentor: Prof. Joydeep Bagchi, Professor, Inter-University Centre for Astronomy and Astrophysics*
- *Project: Observed the '21 cm radiation' from neutral hydrogen in our Galaxy using a Horn Antenna and associated instrumentation at the Radio Physics Laboratory, Inter-University Centre for Astronomy and Astrophysics*

CMR Institute of Technology,   *August 2018 | August 2019*
Student Program Coordinator
Bangalore, Karnataka, India

- *Organised events for creating student awareness on opportunities after completing their Engineering degree.*

- *Guided and mentored students in preparing for Entrance examinations like GRE, GATE, GMAT, JEST.*

Indian Institute of Astrophysics, *Engineer Intern*   January 2018 | March 2018
Bangalore, Karnataka, India

- *Mentor: Dr. Govinda K V, Former Deputy Director, U R Rao Satellite Centre - Indian Space Research Organization*
- *Project: Mechanical Design of 'Fabric Cover Assembly and Dome Cover Mechanism' for the National Large Solar Telescope (NLST).*
- *Contributed to the Mechanical Design aspect of the planned National Large Solar Telescope (NLST) by developing computer-aided designs(CAD) for specific subsystems.*
- *Contributed to the mechanical design and development of 'Fabric Cover Assembly and Dome Cover Mechanism' for the NLST using CATIA V5 software.*
- *Participated in the concept development for the various retractable dome models proposed for NLST.*

CMR Institute of Technology, *Intern*   July 2017 | September 2017
Bangalore, Karnataka, India

- *Mentor: Professor Rajesh Gopal, Department of Physics, CMR Institute of Technology*
- *Project: Reading project - Introduction to Cosmological Perturbations*

Raman Research Institute, *Intern*   December 2016 | February 2017
Bangalore, Karnataka, India

- *Mentor: Professor Shiv K Sethi*
- *Project: Introduction to Fundamentals of Astronomy Astrophysics, Cosmology and Particle Physics*

Times of India - Bennett, Coleman and Company Ltd., *Student Journalist*
April 2012 | April 2014
Bangalore, Karnataka, India

- *Trained as a Student Journalist by one of India's most reputed news houses - Times of India and Times of India-NIE.*
- *Worked in all sections such as reporting, editing, publishing, printing, etc.*
- *70+ articles published covering a plethora of genres - sports, education, local events, history series, etc.*

Leiden/ESA Astrophysics Program for Summer Students (LEAPS), *LEAPS Fellow*
CANCELED DUE TO COVID-19

Inter-University Centre for Astronomy and Astrophysics - Visiting Student Programme, *Selected*
CANCELED DUE TO COVID-19

Teaching Experience	***Graduate Teaching Assistant for PHYS 13: Life in the Universe (Astrobiology)***, *Supervisor: Dr. Shelley Wright, Associate Professor of Physics, UC San Diego* *April 2023	Present*
	Graduate Teaching Assistant for PHYS 5: Stars and Black Holes, *Supervisor: Dr. Quinn Konopacky, Associate Professor of Physics, UC San Diego* *September 2022	December 2022*
Posters	***'Effect of Cosmic Magnetic Fields on Angular Momentum of Protogalaxies'***, ***P.R.Karpoor***, *R.Gopal* *at 238th Meeting of American Astronomical Society (June 2021)*
	Review Poster on 'Seismic Isolation in Advanced LIGO: Current Trends', ***P.R.Karpoor*** *at the 'Modern Engineering Trends in Astronomy (META) 2018' at National Centre for Radio Astrophysics (September 2018)*
	Rapid 3D Printing Using Bi-Wavelength Photo Solidification: A Study', ***P.R.Karpoor*** *at the Conference of Society of Women Engineers [WE Local India 2019] (March 2019)*
Oral Presentations	***Deep Redatuming of Chandrayaan − 2 Large area Soft X-ray Spectrometer (CLASS) for Chemical Mapping of the Lunar Surface***, ***P.R.Karpoor***, *P.Bharadwaj, N.S.Pillai, S.Narendranath* *at 5th Planetary Data Workshop and Planetary Science, Informatics Data Analysis Meeting Organized by Lunar Planetary Institute and Universities Space Research Association (June 2021)* *The presentation and talk can be viewed here.*
	Review Paper Presentation on "Satellite and Space Navigation using Pulsars: A Novel Method, *at SRISHTI, a State Level Technical Fest at R.V. College of Engineering, Bangalore, India (May 2017)*
Publications	***Deep Redatuming of Chandrayaan − 2 Large area Soft X-ray Spectrometer (CLASS) for Chemical Mapping of the Lunar Surface***, ***P.R.Karpoor***, *P.Bharadwaj, N.S.Pillai, S.Narendranath* *(Manuscript in Preparation)*
	Deep Learning based Classification of Galaxy Morphology using Vision Transformers, ***P.R.Karpoor*** *(Manuscript in Preparation)*
	Effect of Cosmic Magnetic Fields on Angular Momentum of Protogalaxies, ***P.R.Karpoor***, *R.Gopal* *(Manuscript in Preparation)*

Faraday Rotation Measure power spectrum due to primordial magnetic fields,
P.R.Karpoor, *R.Gopal*
(Manuscript in Preparation)

Relevant Coursework	***Astronomy:*** *Machine Learning in Physics, Survey of Astronomy, Radiative Processes, Stellar Structure and Evolution, Planets and Exoplanets, Physical Estimation*
	Mathematics: *Linear Algebra, Calculus, Vector Calculus, Complex Variables, Finite Element Analysis, Ordinary and Partial Differential Equations, Probability, Statistics, Numerical Methods*
	Engineering Physics: *Quantum Mechanics, Material Properties, Nanophysics, Crystal Structures, Lasers and, Optical Fibers*
	Engineering: *Basic Electrical Engineering, Programming in C and Data Structures, Material Science and Material Mechanics, Basic and Applied Thermodynamics, Kinematics and Dynamics of Machinery, Fluid Mechanics and Turbo Machinery, Theory of Vibrations, Heat Transfer, Basic Electronics, Mechatronics Control Engineering, Computer-Aided Engineering and Machine Design, Finite Element Analysis, Machine Design, Additive Manufacturing, Project Management*

Skills	***Operating Systems****:*	*Windows, Mac OS, Linux*
	Computer Programming Languages*:*	*Python, MATLAB, C, C++, HTML, IDL*
	Machine Learning Frameworks*:*	*TensorFlow, PyTorch, PySR*
	Software and Tools*:*	*Git, AstroImageJ, SAO DS9*
		FITS Liberator, LaTeX, Origin
	Mechanical Engineering Tools*:*	*CATIA, ANSYS, SolidWorks, SolidEdge*
		CNC Programming

Awards

Astronomy Excellence Award, *UC San Diego*   *March 2022*
Awarded in recognition of academic record, academic achievements to date and promise as an astronomy graduate student.

Gold Medalist for Academic Year 2019-2020, *CMR Institute of Technology, Bangalore, India*   *September 2020*
Recognized for ranking 1st among 1000+ students throughout the 4-year course.

Society of Women Engineers - WE Local India Scholarship Winner, *Society of Women Engineers*   *March 2021*
Awarded Scholarship to attend the WE Local India Conference (India's Largest Women-in-Engineering Event) and Society Membership.

Global Ambassador, *Society of Women Engineers*   *July 2021*
Selected as one among 100 Women to represent the Society of Women Engineers, which is the largest organization in the world for Women in STEM with a primary aim of advocacy for Women in STEM

Global Ambassador, *Society of Women Engineers*   *July 2020*
Selected as one among 104 Women to represent the Society of Women Engineers, which

is the largest organization in the world for Women in STEM with a primary aim of advocacy for Women in STEM

Global Ambassador, *Society of Women Engineers*   July 2019
Selected as one among 90 Women to represent the Society of Women Engineers, which is the largest organization in the world for Women in STEM with a primary aim of advocacy for Women in STEM

65+ Awards, *Awarded by various Organizations over 14 years at International, National, and State Level in recognition for excellence in Academics, Creative Arts, and Leadership.*

Professional Memberships

American Astronomical Society (AAS)
Astronomical Society of India (ASI)

Schools And Workshops

ICTS Workshop on Inverse Problems Related Topics *(Online)* October 2021
IIA Summer School in Astronomy *(Online)*   July 2021
ICTS Summer School on Gravitational Wave Astronomy *(Online)* July 2021
Sagan Exoplanet Summer Workshop 2021 *(Online)*   July 2021
4th LIGO-Virgo Gravitation Wave Open Data Workshop *(Online)* May 2021
IUCAA Workshop on UV Astronomy *(Online)*   December 2020
Sagan Exoplanet Summer Workshop 2020 *(Online)*   July 2020
ICTS Summer School on Neutron Stars and Black Holes   May-June 2019
ICTS Summer School in Astronomy   May-June 2018
IIA Summer School in Astronomy   Feb-May 2017

Outreach

Content Research and Creation, *Astronomical Society of India*
December 2021 - Present

- *Assisting Dr. G.Srinivasan (Member of Apex Science Board, Indian Space Research Organization) in developing a lecture series in Astronomy and Astrophysics.*
- *This series of 35-40 lectures are aimed at advanced undergraduates, as well as Masters level students.*
- *My role involves researching and creating content for these lectures as well as recording, editing and getting them ready for publication on the social media portals of the Astronomical Society of India.*

Content Creation Lead, *Society of Women Engineers*   July 2020 - July 2021

- *Co-ordinate a team of 25 Global Ambassadors from across the world to scout and bring out news regarding Women in STEM*
- *Run social media accounts for Society of Women Engineers*
- *Organize events to promote minorities in STEM fields. Ensure global participation.*
- *Lead regional content creation by covering achievers who usually go unnoticed and helping convert content into regional languages to ensure wider reach*

Blogger, *Society of Women Engineers*   July 2019 - Present

- *Write blogs on events and experiences of Women in STEM*

Member, *Women in STEM Research*   Jan 2021 - Present

- *Conduct events and handle social media to help women pursue STEM Research*

Volunteer, *Team Everest NGO*   *May 2021 - June 2021*

- *Curriculum Writer for 'Speak Out' - An English Literacy Program for Underprivileged Children*

References

Dr. Adam J. Burgasser,
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Dr. Christopher A. Theissen,
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Centre for Astrophysics and Space Sciences
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Professor, Raman Research Institute (Retired)
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