Abhas Pradhan

Department of Sun and Heliosphere
Max Planck Institute for Solar System Physics,
37077, Göttingen, Germany
pradhan@mps.mpg.de
abhaspradhan00@gmail.com

IMPRS PhD
Male

EDUCATION

Degree	Instituition	Year	Score
IMPRS PhD Student	MPI for Solar System Research, Göttingen	2023-	
Integrated M.Sc. *Physics*	Indian Institute of Technology Kharagpur	2018 - 2023	8.64 out of 10
Intermediate/12th	Kendriya Vidyalaya Kharagpur	2018	92.7/100

RESEARCH INTERESTS

- Signatures of coronal heating mechanism; physical description of these signatures from latest high temporal and spatial resolution data
- Study of instabilities in different layers and at different scales in the solar atmosphere; connecting these events to their possible transition region or chromospheric origins
- Coronal Mass Ejections, their evolution and how they interact with the surrounding corona and extended corona; Connecting the CMEs to their origins and studying their inner corona properties to understand acceleration and energy and mass budget.
- Development of data analysis techniques and packages to facilitate studies involving large volume of data from space-based solar observatories; contributing to open source code essential for heliophysics research.

TECHNICAL SKILLS

- **Programming & Scripting Languages**: Python, C, C++, MATLAB
  - Competent with Python libraries and Image processing techniques used in Solar Physics
- Competency to develop and work with Arduino micro-controllers and embedded systems.

TRAINING & WORKSHOPS

- **Visiting Student at Aryabhatta Research Institute of Observational Sciences, Nainital, India** *December 2021 - Present*
  - Under the guidance of Prof Dipankar Banerjee
- **Attended Aditya-L1 Science Support Cell Workshop at ARIES , Nainital and MCNS,Manipal** *June and November - 2022*
- **Intern at Indian Institute of Astrophysics, Bengaluru, India as a part of NIUS** *December 2019-October 2021*
  - Under the guidance of Prof Dipankar Banerjee
- **Attended Workshop on High Performance Computing for Astrophysics** *October 2021*
- **Summer Trainee at National Incentive for Undergraduate Sciences,Physics(NIUS) held at HBCSE, TIFR, Mumbai** *May 2019*

PUBLICATIONS

- **Connecting CMEs to their Source Regions and studying their kinematics** | (***https://arxiv.org/abs/2307.13208***)
  - CMEs obtained from the CDAW catalogue from solar cycles 23 and 24 were observed using LASCO C2 loaded up on jHelioviewer. SDO and SOHO data was used to trace the origins of upto 3000 CMEs and were categorised as Active Regions, Prominence Eruptions or Active Prominences. Histograms of latitude, speed and width distributions according to source type were plotted and analysed. A comparison of the trends of the plots was assessed for two different cycles as well. The results obtained and the catalogue are due publication.

PROJECTS

- **Study of intense geomagnetic storm and investigating their sources using in-situ observations** |
  - Master's thesis project; Supervisor - Dr Nishu Karna, CfA Harvard University
  - The project aims to study and compare intense geomagnetic storms that affect Earth from two different sources,i.e., Coronal Mass Ejections and Coronal Holes.
  - 21 intense geomagnetic storms with $D_{st} < -100nT$ events have been identified since 2010, for which a source region analysis is done. The source region is identified by studying images from SDO-AIA, LASCO C2 and STEREO COR2 and EUV as well. We used in-situ data from ACE and WIND to refer to parameters such as magnetic field strength, number density, pressure, temperature, velocity and elemental abundances of the solar wind. This includes spectroscopy of particles such as Helium, Carbon and electrons. We analyzed and compared the coronal hole data with the CME events. This is a work in progress.
- **Study of Effect of CMEs on F and K corona** |
  - STEREO COR2 polarized brightness images were combined to give Total brightness images of the corona. The polarized and unpolarized components were separated to isolate the light from the K corona and F corona. The electron density of the K corona has been estimated using Van de Hulst coefficients and a time evolution of this density as the CME progresses will be studied.
- **Resolving Coronal Strands and estimating their widths from EUV-HRI171 data onboard Solar Orbiter**
  - Coronal strands intensity profiles are derived from high resolution MGN-enhanced active region images taken by EUV-HRI171 on the Solar Orbiter. The profiles are detrended and FWHM of the strands are derived from Gaussian fitting of the profiles. The method used has been improved substantially from the previous work to provide more accurate results. A statistical study of strands from on-disk, limb and polar regions has been done and their distributions are being studied.
- **FlareVox: A web based application to detect Solar Flares using X-Ray Light curves from Chandrayaan 2 XSM**
  - A web tool was independently developed for detecting flares in X-Ray Light curve data using background estimation and local maxima methods. The algorithm implemented can detect microflares as well. It has an interactive UI and can generate tables regarding the class, rise and decay parameters of every flare detected. The entire web tool was designed for integration with Chandrayaan 2 XSM by ISRO but works for any light curve data.
    This product was the runners up at Inter-IIT Tech Meet 2022.
- **Chandrayaan-2 Moon Mapping Challenge Inter-IIT Tech Meet 2023 | Solo Gold winner**
  - Proposed a novel GAN-based architecture to reconstruct lunar terrain at higher resolution from 5m per pixel to 30cm per pixel.
  - Developed a Lunar Atlas by correcting coordinates and stitching together individual iages from the Chandrayaan-2 TMC Payload.

COURSES TAKEN

- Electrodynamics 1 and 2
- Fluid Mechanics
- Computational Physics 1
- Introduction to Astronomy and Astrophysics
- Pattern Forming Instabilities
- High Performance Computing for Complex Physical Systems (current semester)
- Physical Cosmology (current semester)

EXTRA-CURRICULAR ACTIVITIES

- Scientific head for the team behind Chandrayaan-2 Super Resolution challenge which won Solo Gold(2023)
- Scientific head for the team behind FlareVox at Inter IIT Tech meet 2022 which won silver(2022)
- Built a follower robot at the embedded workshop conducted by Robotix IIT Kharagpur (2018)
- Junior Editor for STEM magazine IIT Tech Ambit (2020)
- Participated in Asteroid Hunt programme by DST-Rajasthan and IAU (2020)
- Love playing football and badminton.