SNEHA VAIBHAV PANDIT

Post-doctoral Researcher, Inter University Centre for Astronomy and Astrophysics
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CAREER OBJECTIVE

I am motivated to understand the origins of life. I want to be a part of the evolution of scientific understanding. I want to become a professor and a scientist, I want to keep on learning the complexities of the universe and pass that knowledge on in the best way I can, by writing research papers, blogs and books, and teaching the young ones.

EMPLOYMENTS

Post-doctoral fellow under CEFIPRA
Topic: Investigation of the Origin of Switchbacks in the Solar Corona via Interchange Reconnection: A Statistical and Multi-instruments Approach Including Machine Learning — Since February 2024
Inter University Centre for Astronomy and Astrophysics, Pune, India

EDUCATION

PhD in Theoretical Astrophysics
Thesis: A new look at Solar-Stellar Activity with the Atacama Large Millimeter/submillimeter Array — August 2019 - December 2023
Rosseland Centre of Solar Physics, Institute of Theoretical Astrophysics, University of Oslo, Norway

BS-MS Dual Degree in Science
Major: Physics, Minor: Engineering Sciences — August 2014 - May 2019
Indian Institute of Science Education and Research, Bhopal, India CGPA: 8/10

HSC, Class XII — June 2013 - April 2014
Ramnivas Ruia Junior College, Matunga, Mumbai-19, 87%

SSC, Class X — March 2012
Saraswati Secondary School, Naupada, Thane, Maharashtra, 97%

TECHNICAL SKILLS

Programming Languages known	Python, Mathematica, Fortran90, IDL
Programming Packages worked with	RH, RH15D, Multi3D, CO5Bold
Software Packages worked with	Origin, Gnuplot, LaTeX, Zotero, CASA, Vapor, Paraview, jupyter lab
Operating Systems	Windows, Ubuntu, MacOS, Linux
High Performance Computing	Stornext, Betzy, Sigma 2

LANGUAGES

English	Fluent **General GRE** [(321/340): V: 154 Q: 167 A: 4] **TOEFL** [(110/120): R: 27 S: 28 L: 30 W: 25]
French	Beginner **DELF A1** [(82/100) R: 24 S: 20 L: 18 W: 20]
Norwegian	A2-B1
Marathi	Mother Tongue
Hindi	Mother Tongue
Sanskrit	Mid level
Bengali	Speaking and Listening

RESEARCH INTERESTS

Keywords: Sun-Earth connection, In-situ observations, Magnetic Switchbacks, Radiative Transfer, millimetre Observations, Numerical Methods, Chromospheric Diagnostics and Activity Indices

Solar Activity and it's effects: My PhD research has primarily focused on studying the chromosphere using observations from the Atacama Large Millimetre/submillimetre Array (ALMA). I have specifically worked on synthesising data for millimetre and Ca II and Hα spectral lines. In my current research, I further explore the outer layer of the Sun and similar stars, known as the corona, with the goal of investigating the chromosphere-corona-connection during active events. By studying these events, I hope to gain insights into the temporal and spatial evolution of magnetic fields and the transfer of energy in this region. To enhance our understanding of these energetic events, I believe it is crucial to employ FORWARD model synthesis. These simulations will allow for a comparison between observational data from instruments such as ALMA, Giant Metrewave Radio Telescope (GMRT), Murchison Widefield Array (MWA), and Square Kilometre Array (SKA), the Parker Solar Probe (PSP), Solar Orbiter (SolO), Solar Dynamics Observatory (SDO), Helioseismic and Magnetic Imager (HMI), Interface Region Imaging Spectrograph (IRIS), and Interferometric Bidimensional Spectrometer (IBIS) and recent Aaditya L-1 Solar UltraVoilet Telescope (SUIT) with synthetic data obtained using close-to-realistic self-consistent 3D R-MHD model atmosphere like Bifrost and event specific modelling.

It is essential to utilise models in conjunction with extensively studied data obtained from ground-based and space-based observations, as well as synthesised data. By integrating these different datasets, we can develop a more comprehensive understanding of the outer solar atmosphere, which can give us better perspective of the solar wind which in tern affects the space weather. This can further provide insights on effects of the solar magnetic activity on the planetary magnetic cycles.

Stellar Activity: In the long term, my research interests revolve around measuring the activity of the Sun and other stars. I am particularly interested in determining what can be inferred about the outer atmospheres of stars based on stellar observations and activity indicators. I aim to explore how these indicators can provide insights into the temperature and density stratification of stellar atmospheres and the potential habitability of star systems.

RESEARCH EXPERIENCE

investigation of the Origin of Switchbacks in the Solar Corona via Interchange Reconnection
Prof. Dr. Durgsh Tripathi, IUCAA Pune, India,
Dr. Clara Froment, CNRS Orleans, France,
Dr. Vishal Upendran, LMSAL, California, USA *Since February 2024*

Switchbacks are observed as sudden and large deflections in the magnetic field in the in situ data ubiquitously in the inner heliosphere. One of the prominent hypotheses for the origin of switchbacks relates to dynamic activities in the solar atmosphere. We study small scale jets and transient events in the solar corona through Solar Dynamics Observatory (SDO) and perform a statistical comparative analysis with switchback events observed by the Parker Solar Probe (PSP). We analyse the statistical association between these events, and perform a quantitative analysis to address the solar connectivity of in-situ structures.

- Using data from Magnetometer control boards (MAG), search-coil magnetometer (SCM), Solar Probe Analyzers Instruments (SPAN-I), Solar Probe Cup (SPC) onboard Solar Wind Electrons Alphas and Protons investigation (SWEAP) on the PSP.
- Identifying events from the PSP data with deflation in magnetic field accompanied by the change in solar wind regime for checking if the two have correlation.
- Backmapping the PSP observed data to the coronal observations using an algorithm by Bizien et al 2024.
- Using SDO data from the identified backmapped time for the events for coronal channels from AIA imager and photospheric magneto gram from HMI imager, extrapolating magnetic field structures to higher heights for better understanding of the structures from the event.
- Using Switchbacks catalogue for understanding global properties of switchbacks like the duration, waiting time, shapes, solar wind speeds and other observables from the PSP data.

EMISSA - Exploring Millimetre Indicators of Solar-Stellar Activity August 2019 - December 2024
Prof. Dr. Sven Wedemeyer, RoCS-ITA, UiO

The Sun, being the nearest star, can be observed well resolved and thus be used as a reference case for solar-like stars. Atacama Large Millimetre/sub-millimetre Array (ALMA) is a new set of eyes to look at the stars including our Sun. Specifically, the brightness temperatures provided by ALMA shed light on the activity and the thermal structure of stellar atmospheres. Sun as a star approach uses the ALMA for a re-evaluation of the activity of stars by means of a comparative solar-stellar study with the Sun serving as a fundamental reference. The global aim of

the study was to establish more robust solar/stellar activity indicators using ALMA observations in comparison with classical diagnostics.
Used publically available Bifrost en024048 snapshot(s) in Multi3D to synthesise Hα line profiles and in RH to synthesise mm continuum and Ca II line profiles.
Using solar ALMA observations: full disk and interferometric, α Cen A spectral data and ALMA data and SDO archival full-disk observations.
Using different statistical and comparison methods like correlation coefficients and power spectral density.
Using 1D semiempirical models like VAL, FAL and Maltby Sunspot models for comparison.
Using different literature definitions for activity indices: Hα linewidths, S index, Ca II IRT index, Hα index, R_{CaII} indices, R'$_{CaII}$, and indices for stellar activity.

Study of Phase Transitions from Neutron Stars to Quark Stars May 2018 - April 2019
MS Thesis with Prof. Dr. Ritam Mallick , IISER Bhopal

- Studied shocks in order to understand the phase change of the quarks in the cores of the neutron stars.
- Solved the relativistic hydrodynamic system of hyperbolic partial differential equations to model a star for understanding the phase transition triggered by the shocks.

Variation of Colour and Nuclear Velocity Dispersion with Separation in Interacting galaxies
Summer semester internship with Prof. Dr. Mousumi Das, IIA, Bangalore *May 2017 - July 2017*

- Searched for double-nucleated galaxies from the papers by Mezcua et al (2014), Gimeno et al (2004), Koss et al (2010) and Ge et al (2012) to extract the data from the NED server (SDSS) for radial accretion, declination, g and r, redshift, velocity dispersion, systemic velocity and cosmologically corrected conversion factor for both the nuclei of the interacting system.
- The relation between the mean velocity dispersion and mean g-r shift with the projected separation was analyzed.

Preparation and Characterization of the innovative Spinel MnNi2O4 May 2016 - July 2016
Summer semester internship with Prof. Dr. Parasharam Shirage, IIT Indore

- Study of supercapacitor, a very novel type of energy solution.
- Preparation of MnNi2O4, a spinel, by various techniques.
- Performed SEM, XRD, BET, FTIR and CV, EIS, GCD on the material.
- Found that this material can reach an exceptionally high specific capacitance 2192F/g.

The Solar Magnetic field and its Manifestation in the form of Dynamical Events
Summer semester internship with Dr. Mukul Kumar, IISER Bhopal *May 2015 - July 2015*

- Reviewed material related to the impact of solar activities on the space weather.
- research experience in the field of solar physics and Magnetohydrodynamics.

Remote sensing by LED lights - LDR circuits at Paryavaran Expo held by DST Maharashtra
for proper irrigation and water conservation *second prize in the state in 2013*

PUBLICATIONS

Statistical Investigation of the Origins of Switchbacks in the solar Corona
***Sneha Pandit**, Durgesh Tripathi, Clara Froment, Vishal Upendran, Thierry Dudok de Wit, Gabriel Suen*
In preparation, (2025)

A comparison of G-band brightness as a proxy-magnetometer in various magnetic configurations
*Malay Shukla, **Sneha Pandit**, Nitin Yadav*
Submitted to MNRAS, (2025)

EMISSA (Exploring Millimeter Indicators of Solar-Stellar Activity): V. Full-disk observations of the Sun
***Sneha Pandit**, Sven Wedemeyer, Atul Mohan, Sowmya Krishnamurthy, Henrik Eklund*
In preparation

EMISSA (Exploring Millimeter Indicators of Solar-Stellar Activity): III. Ca II indices and millimetre continua

***Sneha Pandit**, Sven Wedemeyer, Mats Carlsson*
Published in: *Astronomy and Astrophysics*, Vol. 687, No. A151 (2023)
DOI:10.1051/0004-6361/202347204 arXiv link: https://arxiv.org/abs/2405.04871

Comparison of chromospheric diagnostics in a 3D model atmosphere: Hα linewidth and mm continua
***Sneha Pandit**, Sven Wedemeyer, Mats Carlsson, Mikolaj Szydlarski*
Published in: *Astronomy and Astrophysics*, Vol. 673, No. A137 (2023)
DOI:10.1051/0004-6361/202245412 arXiv link: https://arxiv.org/abs/2303.15612

EMISSA (Exploring Millimeter Indicators of Solar-Stellar Activity): II. Towards a robust indicator of stellar activity
*Atul Mohan, Sven Wedemeyer, Peter H. Hauschildt, **Sneha Pandit**, Maryam Saberi*
Published in: *Astronomy and Astrophysics*, Vol. 664, no. L9 (2022)
DOI:10.1051/0004-6361/202244385 arXiv link: https://arxiv.org/abs/2208.04217

EMISSA (Exploring Millimeter Indicators of Solar-Stellar Activity): I. The initial millimetre centimetre main-sequence star sample
*Atul Mohan, Sven Wedemeyer, **Sneha Pandit**, Peter H. Hauschildt, Maryam Saberi*
Published in: *Astronomy and Astrophysics*, Vol. 655, no. A113 (2021)
DOI:10.1051/0004-6361/202142095 arXiv link: https://arxiv.org/abs/2110.13339

TEACHING ASSISTANCE EXPERIENCE

AST5770: Solar and Stellar Physics
Institute of Theoretical Astrophysics — Spring semester 2022

RESEARCH VISITS

CEFIPRA Fellow, LPC2E, CNRS Orleans, France — 8 September - 3 October 2025
STCE Seminar Fellow, Royal Observatory of Belgium, Brussels, Belgium — 17-20 September 2024
CEFIPRA Fellow, LPC2E, CNRS Orleans, France — 26 August - 6 September 2024

TALKS/ SEMINARS

Switchbacks Statistics using Catalogue
Talk, LPC2E, CNRS Orleans, France — 25 September 2025
Investigating the Origins of Switchbacks in the solar Corona
The 125 years of KSO Sun, Space Weather, and Solar-Stellar Connection Conference
IIA Bangalore, India — 20-25 January 2025
Long Term Solar Activity Using mm Indicators + Investigating the Origin of Switchbacks in the Solar Corona using Statistical Approach
STCE Seminar, Royal Observatory of Belgium, Brussels, Belgium — 17 September 2024
Long Term Solar Activity Using mm Indicators + Investigating the Origin of Switchbacks in the Solar Corona using Statistical Approach
Department Seminar, Department of Physics, University of Helsinki, Finland — 10 September 2024
Corona-Solar wind connection using new spacecraft data
SRL Seminar, Department of Physics and Astronomy, University of Turku, Finland — 9 September 2024
Long Term Solar Activity Using mm Indicators
Institute Seminar, LPC2E, CNRS Orleans, France — 28 August 2024
The Formation of Activity Indicators in 3D Model Atmosphere
RoCMI (RoCS/ MUSE/ IRIS) Workshop, Svalbard, Norway — 27 February- 2 March 2023
The Formation of Activity Indicators in 3D Model Atmosphere
IAUGA 2022 IAU Symposium 372, BEXCO Busan, Republic of Korea — 2-5 August 2022
The Formation of Activity Indicators in 3D Model Atmosphere
COSPAR, Athens, Greece — 16-23 July 2022
The Formation of Activity Indicators in 3D Model Atmosphere
Cool Stars 21, Toulouse, France — 4-8 July 2022
The Formation of Activity Indicators in 3D Model Atmosphere
50 years to Skumanich Relations, HAO, Boulder, USA — 7-10 March 2022
mm indicators of the solar stellar activity: full disk observations of the sun

NASA Heliophysics summer school, Boulder, USA 14-25 June 2021
The sun as a star: new insights from the full disk observations with ALMA
16th European Solar Physics Meeting, Online 6-10 September 2021
Analysis of full disk solar observations from ALMA
50th Young European Radio Astronomers Conference (YERAC), Grenoble, France 24-27 August 2021

CAMPS/ SYMPOSIUMS/WORKSHOPS ATTENDED

Parker Heliophysics Scholars 10th meeting
Virtual Meeting 12-14 November 2025
Parker Heliophysics Scholars 9th meeting
Virtual Meeting 20-22 May 2025
Parker Heliophysics Scholars 8th meeting
Virtual Meeting 19-21 November 2024
Parker Heliophysics Scholars 7th meeting
Virtual Meeting 28-30 May 2024
IIA symposium
Indian Institute of Astrophysics, Bangalore, India 1-4 March 2021
Cool Stars 20.5
Virtual Meeting 2-4 March 2021
SOLARNET school A holistic view of the solar atmosphere: combining space and ground-based observations
UCL Mullard Space Science Laboratory, Dorking, UK 25-29 January 2021
2nd International Workshop on Solar Imaging with ALMA
Member of LOC, RoCS, UiO, Oslo, Norway 3-5 Nov 2020
Virtual Annual Meeting of the German Astronomical Society 21-25 September 2020
STFC Introductory Solar System Plasmas Summer School
University of Birmingham, UK 24-27 August 2020
1st International Workshop on Solar Imaging with ALMA
RoCS, UiO, Oslo, Norway 2-6 March 2020
Physics Symposium
IISER Bhopal, MP, India 2016, 2017, 2018
GIAN course on CHEMICAL SENSORS: Principles, Technologies and Applications,
IIT Indore, MP, India June 2016
INSPIRE science camp
Khalsa College, Mumbai, MH, India January 2013
National Science Camp,
HBSCE and TIFR, Mumbai, MH, India January 2011

AWARDS/SCHOLARSHIPS

Joint Entrance Screening Test (JEST) 2019 All India Rank: 641 out of 23000 candidates
JEST is a screening test in India conducted to shortlist candidates for admission to MSc, Integrated PhD and PhD programs in physics. It has been declared as a National Eligibility Test (NET) by Science and Engineering Research Board (SERB).

Graduate Aptitude Test in Engineering (GATE) 2019 All India Rank: 1198 out of 15000 candidates
GATE exam is a computer-based standardised test conducted at the national level in India with an aim to examine the understanding of various engineering and science undergraduate subjects. It is mainly administered by Ministry of Human Research and Development (MHRD).

Innovation in Science Pursuit for Inspired Research (INSPIRE) Scholarship for Higher Education (SHE) Aug 2014 to May 2019
Administered by the Department of Science & Technology (DST), India, throughout the 5 year period of BS-MS program at IISER Bhopal.

Maharashtra Boards Mumbai Region SSC 2012 Rank in Mumbai Division: 2nd
Each year around 17,00,000 candidates appear for the exam. I stood second amongst those in the Mumbai Division.

NTSE Scholarship 2010
The NTSE exam is a highly esteemed national-level scholarship program in India, organised by the Government of India. It serves as a source of immense pride and honour for students, as it recognises them as the nation's top talent. 1500 candidates are eligible for this scholarship out of 10 Lakh estimated candidates appearing each year.

High School Scholarship 2009 and Middle School Scholarship 2006; **Homi Bhabha Young Scientist Award 2008**; **Ganit Sambodh, Ganit Pravinya, Ganit Pradnya in 2008, 2005**
These examinations are highly competitive assessments in the disciplines of science, technology, mathematics, logical reasoning, and aptitude, encompassing students from grades 4th to 9th. I achieved commendable rankings in these exams, resulting in the awarding of scholarships throughout my schooling years.

OUTREACH ACTIVITIES

Life under the Sun: Exploring Habitability and Our Sun
At the IAU Office for Astronomy Outreach for the Women of Solar Physics Series — 18 September 2025

School Students' Summer Programme 2025
Instructor to a group of high school students for the summer projects in astrophysics — 28 April -2 May 2025

Event manager at the Pint of Science Pune Edition
First PoS edition in India — 19-21 May 2025

Life under the Sun: Exploring Habitability and Our Sun
At the inauguration of Nowrosjee Wadia college's Physics Club talk — 22 March 2025

The sun and the habitable zone
At the astronomy-themed program with the Maharashtra State Faculty Development Academy — 21 February 2025

Life under the Sun: Exploring Habitability and our Sun
Second Saturday Lecture talk, Chandrashekhar Auditorium, IUCAA SciPOP, Pune, India — 10 August 2024

INDUS team member
In social media and outreach teams in the collective of solar physicists all over the world — August 2023-Now

Glimpse of astrophysics
Outreach talk to 8-year-olds at Northern Lights International School, Oslo, Norway — 20 November 2019

About Astrophysics
Outreach talk to 15-year-olds at Saraswati Secondary School Thane, MH, India — 9 July 2020

How do we understand habitability?
Astrophysics home delivered talk, IBAC, IISER Bhopal, India — 6 July 2021

Norwegian Astronomy Olympiad
Institute of Theoretical Astrophysics — 2020 - 2023

Women in Astro
Blog-posts at Institute of Theoretical Astrophysics — August 2019 - December 2023

Astro-Kids
A public outreach program directed towards elementary school and middle school kids in Oslo hosted by Institute of Theoretical Astrophysics — August 2019 - August 2023

EXTRACURRICULAR AND CO-CURRICULAR ACTIVITIES

I am an active member of INDUS (Indian Network for Dynamical and Unified Solar Physicists) as a coordinator of the outreach team.

I have been reviewing journal papers for the international journal **Astronomy and Astrophyics (A&A)**.

I am one of the members of the **SciPop Committee at IUCAA** from March 2025.

I played as a medium-paced bowler in **Vestli Cricket Club** in Oslo, on an international Level.

I am a certified **cricket umpire** by the ICC through NCF.

In **Inter IISER Sports Meets** I have played Javelin throw, volleyball, football, kho-kho, throw ball for my institute and have won gold medals.

I got selected and visited China in June 2017 as a part of the **Youth Delegation program** by the Ministry of Youth and Sports Affairs, Government of India and Government of China.

I am trained for Indian Classical **Bharatanatyam**. I am a graduate (Visharad) from Nalanda School of Arts, Madras and Gandharva Nritya Vidyalaya, Banaras in 2021 and have performed at various events in India, China and Norway.

I performed on stage as a part of **Drama club** at IISER Bhopal.

I have worked in a daily soap on **television** and have been trained for theatre.

I was the **chief editor** for a regional children's magazine **Jidnyasa** for two years. I like to write poems or extracts occasionally.

I gave talks related to my project works and related topics in the Astronomy club and Physics club, IISER Bhopal.

I was an active member of IISER Bhopal's **social initiative Prayaas** as a visiting science teacher in the Government schools in the Bhauri village.

I was a part of **Students Activity Council Election Committee** at IISER Bhopal.

My team held the position of the regional toppers in **Mimamsa '17** (a National-level annual Science Quiz organized by the students of IISER Pune).