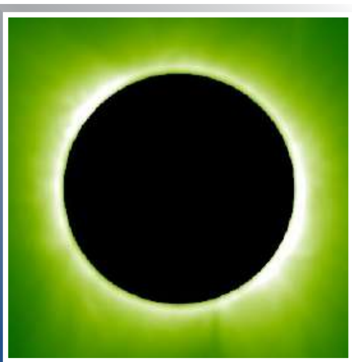
आर्यभट्ट प्रेक्षण विज्ञान शोध संस्थान

Aryabhatta Research Institute of Observational Sciences

(An Autonomous Institute under DST, Govt. of India)

# ANNUAL REPORT

## 2024-25



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# Aryabhatta Research Institute of Observational Sciences

## (An Autonomous Institute under DST, Govt. of India)

Manora Peak, Nainital

ANNUAL REPORT

**2024 - 2025**

(1st April, 2024 to 31st March, 2025)

**ARIES, Annual Report: 2024 - 2025**
**No. 21, 175 pages**



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**Front Cover:**
Inset 1 - The solar corona as observed in 530.3 nm during the total solar eclipse on 8 April, 2024, USA by the ARIES expedition team. *(Credit: Dr. S. Krishna Prasad)*
Background - A nightscape of Comet C/2023 A3 (Tsuchinshan-ATLAS) above the western horizon as seen from Devasthal Observatory, ARIES. *(Credit: Photography by Himanshu Rawat, Processing by Mr. Javed Alam)*
Inset 2 - A long-exposure close-up view of Comet C/2023 A3 captured from ARIES, showing its prominent anti-tail. *(Credit: Dr. Ankush Bhaskar)*

**Back Cover:**
Inset 1 - Ozonesonde balloon launch from ARIES.
Background - ARIES Stratosphere Troposphere Radar's antenna array.
Inset 2 - Mie Lidar facility at ARIES.

**September, 2025**

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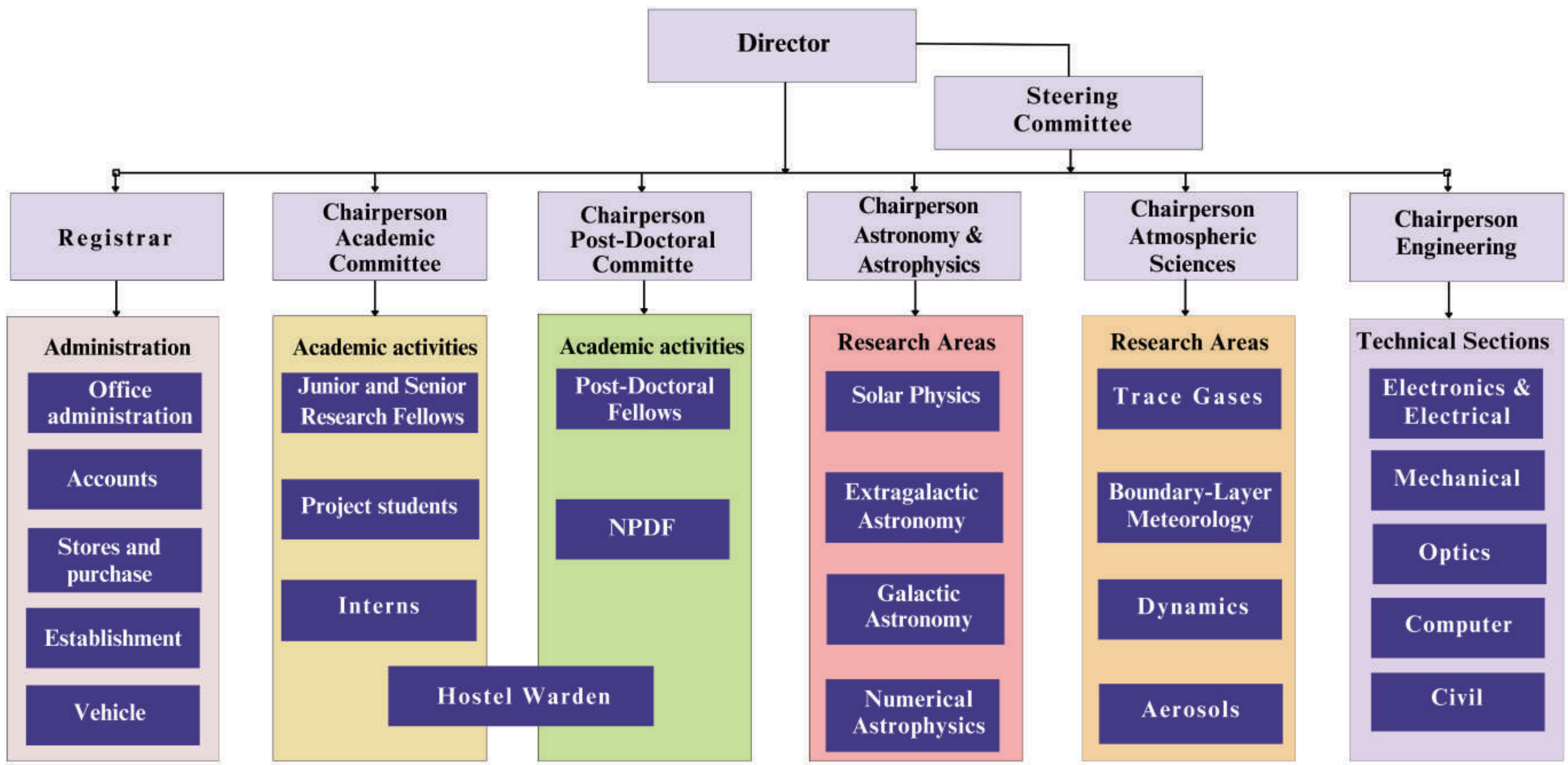

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Bengaluru

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Ministry of Science & Technology,
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Govt. of India, New Delhi

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Director, ARIES,
Nainital

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## CHAIRPERSON

**Prof. Dipankar Banerjee / Dr. Manish Kumar Naja**
Director, ARIES,
Nainital

## MEMBERS

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Department of Science & Technology,
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New Delhi

**Dr. Brijesh Kumar**
Scientist-G,
ARIES,
Nainital

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ARIES,
Nainital

# Statutory Committee

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(Member)
IISER, Kolkata

**Director**
(Member Secretary)
ARIES, Nainital

# Office Bearers

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Director

Prof. Dipankar Banerjee
Director *(till 9-10-2024)*

Mr. Rajneesh Mishra
Registrar

Dr. Jeewan C. Pandey
Chairperson
(Astronomy Division)

Dr. Brijesh Kumar
Chairperson
(Engineering Division; Vigilance)

Dr. Indranil Chattopadhyay
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(Staff Grievance Redressal Committee)

Dr. Yogesh Chandra Joshi
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Dr. Kuntal Misra
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(Internal Complaints Committee against Sexual Harassment)

Mr. Mohit Joshi
Chairperson
(*Hindi Advisory Committee*; CPIO ; KRC and ASPOP)

## The Year in Review

I am delighted to present an overview of our accomplishments for the year 2024-25. I am grateful to my colleagues at ARIES, DST and collaborators from other national and international organisations for their deep commitments and contributions in this endeavour. I would like to point out that I took over the charge as Director, ARIES on 22 October, 2024 for which I would like to extend my heartfelt thanks to all my colleagues and my predecessor.

The research and development activities at ARIES are carried out under three major divisions viz. Astronomy & Astrophysics, Atmospheric Sciences and Engineering. The Astronomy & Astrophysics division is focused on observational, theoretical and analytical studies of celestial bodies. The Atmospheric Sciences division specialises in understanding the physical, chemical, and dynamical processes governing the Earth's atmosphere, with specific attention on air pollution and climate change studies. The engineering division is involved in the design, development, maintenance and upgradation of the observational facilities and the supporting infrastructure of the institute.

Nestled in the Himalayas, ARIES's location provides clear dark skies for astronomical observations as well as a unique eco-sensitive region with complex topography for a myriad of atmospheric measurements. Taking advantage of this, the institute operates a multitude of facilities and instruments from its three campuses at Manora Peak, Devasthal and Haldwani. I am glad to inform the readers that all our major facilities are fully functional and yield several important research results. The largest telescope in the country, 3.6m Devasthal Optical Telescope (DOT) is operated by ARIES as a national facility. SPIM, a new backend instrument for DOT became functional for observations. The time on 3.6m DOT and other 1-m class telescopes at ARIES was allocated following a competitive and rigorous evaluation of scientific proposals received through open calls. ARIES Stratosphere Troposphere Radar (ASTRAD) is an example of India's *Atmanirbhar Bharat* capabilities and it is the only radar facility in the Himalayas for measuring the 3D wind field up to about 20 km altitude. A new high power amplifier section on the Transmit Receive Modules (TRMs) of the ASTRAD has been designed, developed, tested, integrated and activated.

The astronomers at ARIES brought out several important findings. They revealed varied chemical trajectories across the Milky Way Galaxy, utilising a vast repository of open star clusters. Another study revealed the formation of stars in a filamentary molecular cloud. The scientists detected and measured the properties of an Intermediate Mass Black Hole (IMBH) in a faint galaxy 4.3 million light-years away using the 3.6m DOT. This breakthrough study improved the understanding of how black holes grow and galaxies evolve. Using a treasure trove of X-ray data spanning over four decades, powerful flares erupting from the scorching and thin outer atmosphere called the corona of an ultra-fast rotating Sun-like star were unveiled. An international team, in collaboration with ARIES scientists, used NASA's planet hunter satellite TESS to detect the smaller supermassive black hole from the supermassive black hole pair at the centre of a distant galaxy for the first time.

The dynamics of dust in the interstellar medium were found by a polarisation study from the 1.04 m Sampurnanand Telescope (ST). Simultaneous optical and X-ray polarimetric observations of a blazar from ST and Imaging X-ray Polarimetry Explorer revealed that the X-rays are emitted close to the shock, whereas optical light originates from farther down the jet. It is indeed a matter of pride that in spite of being more than 5 decades old, ST is still producing quality science.

Using AI/ML techniques, the scientists at ARIES found the diverse origins of Gamma Ray Bursts (GRBs) and developed a technique for automated transient detection from data of the 4m International Liquid Mirror Telescope (ILMT). Numerical simulation of accretion disk formation around black holes were also carried out. The solar physics group carried out an investigation of nondecaying oscillations in the solar atmosphere. They also went on an expedition of the Total Solar Eclipse on April 08, 2024 to the USA to conduct imaging experiments on the solar corona. It was the only such expedition from India.

The Atmospheric Sciences Division team studied two distinct precipitation events over the Central Himalayas using the ASTRAD and model simulations to reveal contrasting dynamical and microphysical characteristics. First online observations of greenhouse gases (GHGs) over the Central Himalayas were carried out continuously for the past 5 years, highlighting the increasing levels, along with the complex interplay of anthropogenic emissions, biospheric uptake, and weather patterns. The ground based observations ($NO_2$, $SO_2$, HCHO, and CHOCHO) from MAX-DOAS demonstrate that satellite data (TROPOMI and GOME-2) are biased up to 48% over the Himalayan foothills. A multi-site assessment of particulate and gaseous pollutants across the Indo-Gangetic Plain (IGP) and the Himalayan foothills showed contrasting reductions in $PM_{2.5}$ for Delhi/NCR and Nainital. Such studies are of paramount importance to tackle the menace of air pollution and climate change in our country.

New Engineering Lab, Mechanical Workshop and Surya Hostel Block at Devasthal campus were inaugurated by the Honourable Governor of Uttarakhand, Lt. Gen. Gurmit Singh (Retd.) on June 18, 2024. He also felicitated 5 ARIES members who played a crucial role in developing the Devasthal Observatory into a world-class astronomical site. Construction of a new student hostel and a new 200-seater auditorium at Manora Peak is in progress.

ARIES is a centre of excellence for human resource development in Astronomy, Atmospheric Sciences and Instrumentation. During the year, 7 new research scholars and 5 new Post-doctoral fellows have joined ARIES and 9 Ph.D. degrees were awarded. 64 undergraduate/post-graduate students carried out short-term internships. Several capacity building workshops were conducted by the Aditya-L1 Support Cell (AL1SC), which is a joint effort of ARIES and ISRO, to train students and college/ university teachers to use Aditya-L1 mission data. The institute also organised many national and international conferences/workshops/meetings to provide a platform for academic discussions and foster new collaborations such as 6th edition of URSI-RCRS 2024 at GEHU, an international meeting on solar cycle variability at ARIES and IASTA 2024 at Doon University. An MoU was signed with the Navaratna Defence PSU Bharat Electronics Limited (BEL) to collaborate on space technologies, focusing on Space Situational Awareness (SSA). This was a significant step in advancing India's SSA capabilities, in line with the Government of India's 'Atmanirbhar Bharat' and 'Make-in-India' initiatives.

ARIES Foundation Day was celebrated with a 4-day programme, which included a blood donation drive, a 2-day scientific-technical in-house meeting to take stock of research and development activities of the institute and the ARIES Foundation Day Lecture by an eminent guest-speaker in Nainital town.

Disseminating scientific knowledge among the society is a scientific social responsibility for which ARIES have a vibrant public outreach programme. Several activities were conducted on thematic occasions such as the National Space Day, National Science Day, important celestial events etc. Various activities were conducted for awareness on the usage of Hindi. The institute conducted the *Dwitiya Akhil Bhartiya Vaigyanik Evam Takniki Rajbhasha Sangoshthi* in which members from various DST institutes presented talks on their area of work in Hindi. Among 45 offices of Nagar Rajbhasha Karyanvayan Samiti (NaRaKaS), ARIES received second prize for Hindi activities. Several awareness programmes were conducted on important occasions such as the International Day of Yoga, a plantation drive *Ek Ped Maa Ke Naam* on the occasion of Uttarakhand's local festival Harela, *Hindi Pakhwara*, *Swachhta Pakhwada* and *Swachhta Hi Seva* campaign, Vigilance Awareness Week, Constitution Day, Vishwa Hindi Diwas etc. All Govt. of India schemes are implemented as per the directives. The institute always strives for a positive, safe and equitable work environment devoid of any form of discrimination for everyone. Any grievances received from the staff are resolved in a timely manner.

ARIES will continue to excel in research and development activities in the areas of Astronomy& Astrophysics, Atmospheric Sciences and Engineering with its world class observational facilities and would participate in major national and international projects to realise the dream of a *Viksit Bharat*.

**Manish Kumar Naja**
**Director**

# Research Highlights

1.04m ST Telescope

1.3m DFOT

3.6m DOT

4m ILMT

## Astronomy & Astrophysics

The scientists, research scholars and post doctoral fellows at ARIES are involved in core research in Astronomy & Astrophysics (A&A), Atmospheric Sciences and Instrumentation. These are performed under the three primary divisions at ARIES utilising their resources and expertise. The brief research highlights of the institute, during the period 2024-25, are given below.

The A&A division conducts research centred around the Sun and the Solar System, Galactic sources (near earth objects, individual stars, star clusters and star forming regions), Extragalactic sources (external galaxies, active galactic nuclei, time domain studies of transients) and Theoretical and numerical simulations of compact objects.

## Galactic Astronomy

*Research in several areas of Galactic astronomy such as search and study of variable stars in field and star clusters to study the stellar evolution, asteroseismology of late A and F-type stars using high temporal and spectral resolution to understand the internal structure of stars, detailed studies of the eclipsing and compact binaries for the determination of precise stellar parameters, role of rotation and magnetic fields in various physical processes taking place inside the stars, accretion flows in cataclysmic variables to study the extreme physical conditions in stellar interiors, coronal imaging and X-ray flares of cool active stars to study the stellar cycles, coronal imaging, binary evolution, dust and ISM properties towards galactic anti-centre direction for the galactic archeology are being pursued at ARIES.*

### Chemical characterisation of the Milky Way nuclear star cluster

A detailed chemical characterisation of the nuclear star cluster (NSC) of the Milky Way was carried out using high resolution near infrared spectroscopic observations of 9 M giant stars. Using the spectral synthesis method, the abundances of 19 elements was determined along with their trends as a function of metallicity **(Figure 1)**. Based on a systematic and differential analysis, it was shown that the abundance trends of all elements except sodium in NSC follow the trends shown by both the inner Galactic bulge and the solar neighbourhood thick disc stellar populations, indicating a shared formation history among these components **(Figure 2)**. The significant enhancement in sodium, also found in inner bulge metal rich globular clusters, could point to the influence of globular cluster accretion in the NSC. [Ryde, Nils & **Nandakumar, Govind** et al. (2025). *Astroph. Jr., 979, 174 (14pp);* **Nandakumar, Govind** et al. (2025). *Astroph. Jr. Letters, 982, L14 (8pp)*].

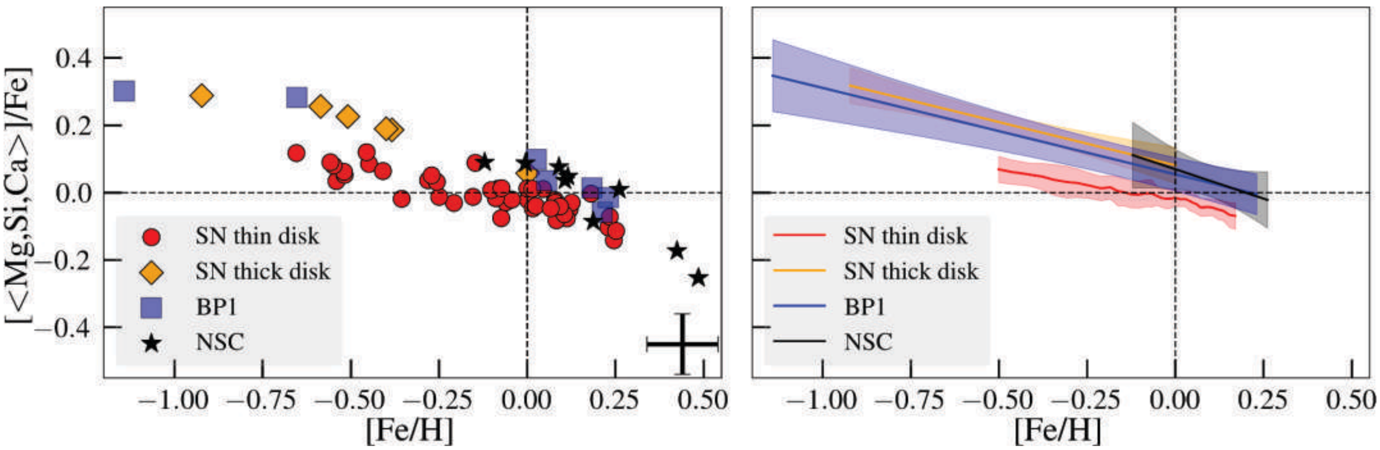



***Figure 1:*** *Left: Straight mean abundance of the three α elements Mg, Si, and Ca vs. [Fe/H] for the NSC (black), inner-bulge stars located 1°N of the Galactic centre (blue), thick-disk stars (orange), and thin-disk stars (red). Right: Running mean for the solar-neighborhood trend and simple polynomial fits (solid line) to the mean α abundances and the respective standard deviations (respective coloured band).*

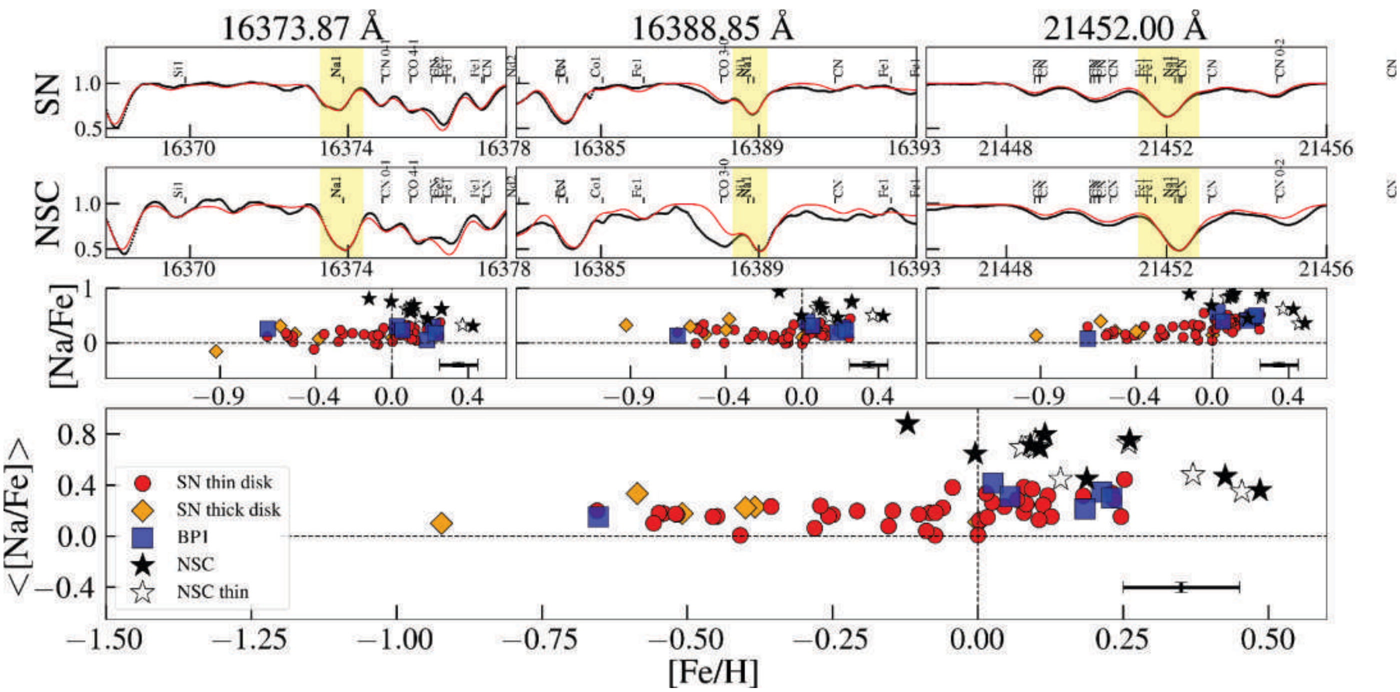



***Figure 2:*** *[Na/Fe] vs. [Fe/H] for different stellar populations. The nuclear star cluster (NSC) stars are represented by black stars, the inner-bulge stars by blue squares, and the solar neighborhood thin-disk stars by red circles, while the thick-disk stars are shown as orange diamonds. Na abundances for NSC stars derived using stellar parameters determined with the thin-disk oxygen abundance trend are represented by black open stars. In the upper two panels, the spectral lines used for the analysis are displayed, with a typical solar neighborhood star shown above and a typical NSC star (FK5020265) shown below. The trends derived from each individual spectral line are presented, along with the mean trend, which is displayed in the largest, bottom panel.*

## A study on the metallicity gradients in the galactic disk using open clusters

The study revealed the emergence of a stark revelation during disparate chemical evolution within the inner and outer boundaries of the Milky Way Galaxy. This revelation stems from an exhaustive analysis of ~2000 open clusters scattered throughout the Milky Way **(Figure 3)**. These clusters offer a unique window into the chemical make-up of our galaxy, spanning a broad age spectrum ranging from few million years to several billions of years, thereby offering a glimpse into the galaxy's gradual evolution over the past ten billion years. This comprehensive study not only underscores the diverse chemical compositions prevalent across different regions of the galaxy but also builds from previous investigations. Two distinct components were identified along the vertical axis of the galactic mid-plane which clearly revealed two components of the Galactic structure known as thin and thick Galactic disk. Moreover, along the galactic plane, a pronounced decline in metallicity was observed, followed by a gradual tapering after approximately 13 kiloparsecs from the galactic centre. It is also revealed that the open clusters formed within the past 240 million years exhibit higher metallicity compared to their older counterparts. **[Joshi, Yogesh Chandra**, **Deepak** & Malhotra, Sagar. (2024). *Front. Astron. Space Sci., 11*: 1348321 (15pp)**]**.

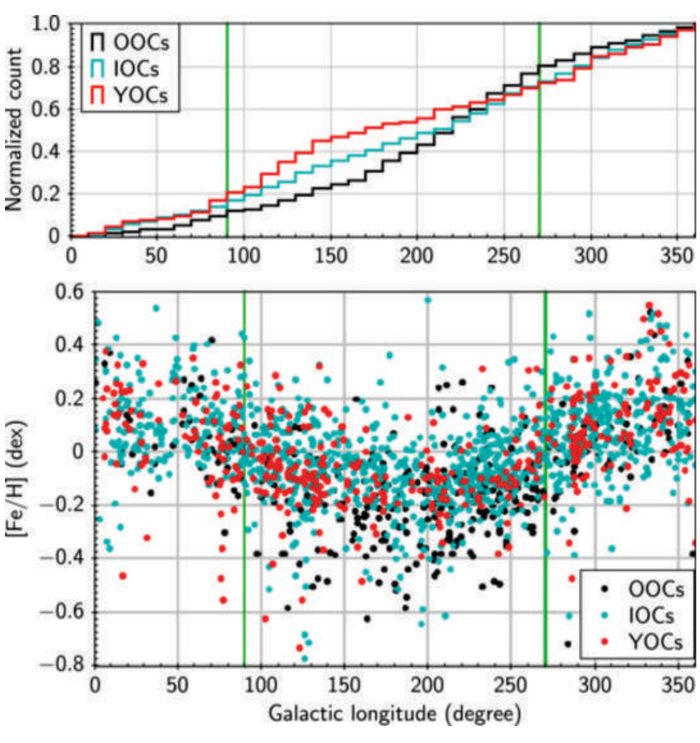



***Figure 3.*** *Metallicity as a function of the galactic longitude for the OCs belonging to the three different age groups. Cumulative distribution along the galactic longitude for OCs in three different age groups is shown in the top panel. In both panels, the clusters between the two vertical green lines (at l = 90° and 270°) are in the anti-GC direction, while the clusters outside these lines are in the GC direction.*

The presence of an extended Main-Sequence Turn-Off (eMSTO) in open clusters has been linked to several contributing factors, including variations in stellar rotation rates, the presence of binary systems, and dust-like extinction from stellar excretion discs. By utilizing spectroscopic data from the Gaia-European Southern Observatory (ESO) archives, it was found that stars on the red side of the eMSTO exhibit a significantly higher average projected rotational velocity ($v \sin i = 135.3 \pm 4.6$ km/s) compared to those on the blue side ($v \sin i = 81.3 \pm 5.6$ km/s). This difference supports the interpretation that the eMSTO in NGC 2355 is primarily driven by a spread in stellar rotation rates. Ultraviolet observations from the Swift survey revealed no significant evidence of dust-like extinction affecting the eMSTO stars, suggesting that circumstellar dust is unlikely to be a major factor in this cluster. Analysis of synchronization timescales for low mass ratio close binaries in the blue region of the eMSTO indicated that such binaries, if present, would predominantly be slow rotators. Interestingly, the blue eMSTO stars tend to be located in the outer regions of the cluster, implying a possible deficiency of low-mass-ratio close binaries in this population. The observed spread in rotational velocities among eMSTO stars in NGC 2355 is likely a result of early star-disc interactions. **[**Maurya, Jayanand et al. (including **Joshi, Y. C. & Kumar, B.**). (2024). *Mon. Not. Roy. Astron. Soc., 532*, 1212-1222**]**.

## Linear polarization study of open clusters reveals signature of the galactic spiral arms

The optical linear polarization measurements of set of open star clusters **(Figure 4)** from 104cm telescope and combining it with the Gaia data, it was found that the degree of polarization and extinction vary with the distance suggesting multiple dust as well as common foreground-dust layers toward different cluster directions that highlight global features such as the galactic spiral arms. The large-scale dust distribution obtained by combining the polarization results with previous similar studies of nearby open clusters suggested that the anticenter direction is characterized by a low-extinction homogeneous dust distribution with a somewhat uniform orientation of the plane-of-sky component of the magnetic field along the line of sight. The study demonstrates that polarization is useful as a tool for studying the large-scale dust distribution and structural features where kinematic distance methods are inadequate and cannot provide accurate distances to the dust clouds. [Uppal, N., Ganesh, S., Pelgrims, V., **Joshi, Santosh** & **Sarkar, Mrinmoy**. (2024). *Astron. Astrophy., 690*, A49 (21pp)].

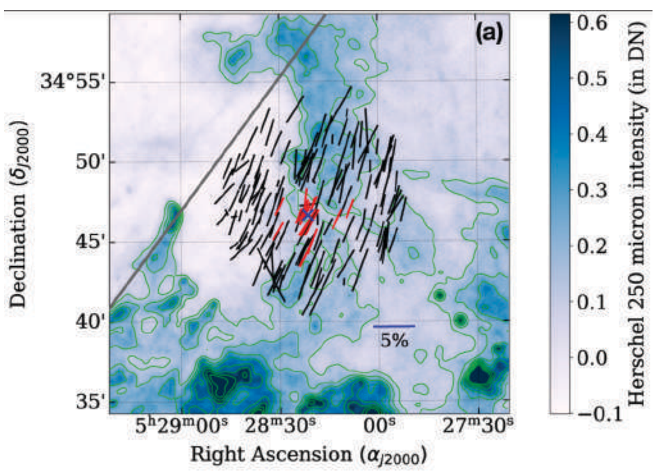



***Figure 4.*** *Herschel 250 µm dust map of Kronberger 1. The contours correspond to the constant Herschel 250 µm intensity. The polarization measurements are overplotted on the dust map. A 5% polarization line perpendicular to celestial north is shown.*

## Low-resolution transit spectroscopy of three hot Jupiters using the 2M Himalayan Chandra Telescope

Low-resolution transmission spectroscopy was observed for three giant exoplanets viz. HAT-P-1b, KELT-18b, and WASP-127b using the Himalayan Faint Object Spectrograph Camera (HFOSC) on the 2-meter Himalayan Chandra Telescope (HCT) at Hanle, India. Each planet was observed during a single transit. To reduce time dependent systematics, the common-mode correction method was applied using a white light transit curve as a baseline. The transmission spectra obtained for WASP-127b and HAT-P-1b were found to be consistent with previous low-resolution observations from other facilities. For WASP-127b, the presence of Rayleigh scattering in its atmosphere was also confirmed. Additionally, the study provided the first low-resolution transmission spectrum for KELT-18b. By modelling the atmospheres of WASP-127b and HAT-P-1b using HFOSC data in combination with infrared observations from the Hubble Space Telescope (HST) and Spitzer Space Telescope, it was demonstrated that HFOSC can serve as a viable optical instrument to complement IR datasets, thereby improving constraints on exoplanet atmospheric properties. [Unni, Athira et al. (including **Joshi, Yogesh C.**). (2024). *Mon. Not. Roy. Astron. Soc, 535*, 1123–1135].

## Transit timing variation of K2-237b: hints toward planet disc migration

Hot Jupiters formation happens at large distances from their host stars and subsequently migrate inward, a process supported by observational evidence such as transit timing variations (TTVs). In this study, TTVs for the hot Jupiter K2-237b were reported and derived from transit times. It was reproduced as well as fitted using data from the Kepler K2 and TESS missions. The observations span 2016-2021, providing a 5-year baseline. The data showed a significant deviation from a constant-period model. A model comparison using the Bayesian Information Criterion (BIC) strongly favours a scenario involving orbital period decay, with a ΔBIC of 14.1. The observed TTVs imply a period decay rate of $-1.14 \pm 0.28 \times 10^{-8}$ days per day. Additionally, spectral energy distribution fitting revealed a marginal infrared excess, with a significance of 1.5σ in the WISE W1 and W2 bands, and approximately 2σ in the W3 and W4 bands. This excess may indicate the presence of a stellar debris disc composed of hot dust at a temperature of 800 ± 300 K, with a dust to stellar luminosity ratio of L_dust/L_star= $(5 \pm 3) \times 10^{-3}$. Isochrone fitting yielded a stellar age of $\sim 1.0 \times 10^9$ years. The characteristics of K2-237b, including its period decay and potential circumstellar dust, offer observational support for the disc driven migration scenario of hot Jupiters. [Yang, Fan et al. (including **Joshi, Yogesh C.**). (2024). *Mon. Not. Roy. Astron. Soc. Letters, 535*, L7–L12].

## Indications of magnetic accretion in Swift J0826.2-7033

The first long XMM-Newton observation of the cataclysmic variable Swift J0826.2-7033 suggested that it belongs to the intermediate polar class. A short-

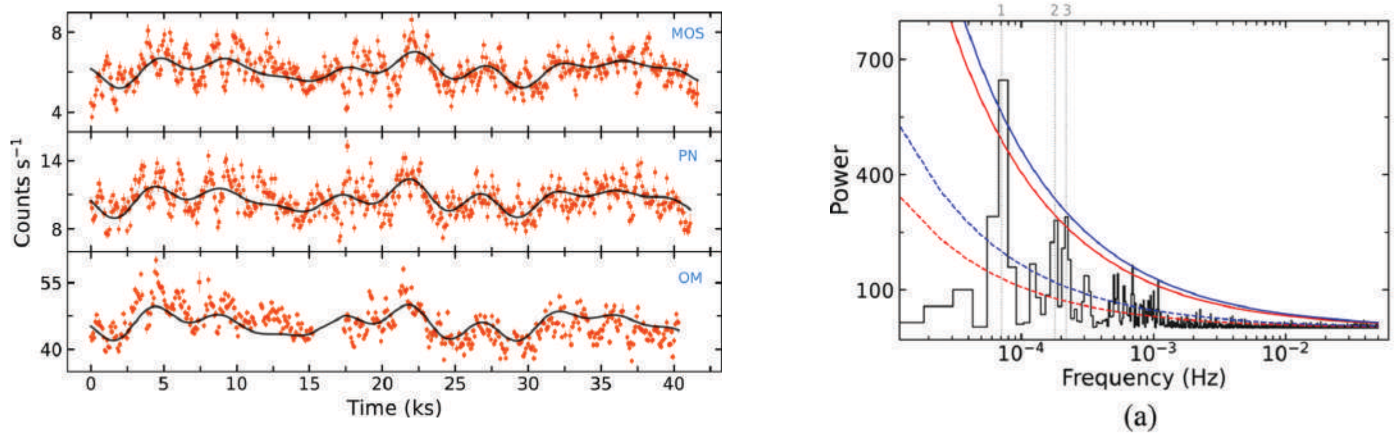



*Figure 5. Left: X-ray and optical light curve of Swift J0826.2-7033 as obtained from MOS, PN and OM instruments of XMM-Newton. Right: The power spectra as obtained from the PN light curve.*

and long-term variability in both X-ray and optical wavelengths were detected. The ~14,000 s long term variation likely corresponds to half the orbital period, while ~4,600 s and ~5,600 s variations represent the spin and beat periods respectively, implying disc-overflow accretion **(Figure 5)**. These spin and orbital variations are energy independent, suggesting changes in the emitting area. Spectral analysis revealed a multi-temperature post shock region with a maximum temperature of ~43 keV, yielding the mass of white dwarf as 0.82–0.93 $M_{\odot}$, consistent with estimates from a post-shock region model. Notably, the X-ray spectrum showed suprasellar abundances, which, along with a potentially long orbital period and evolved donor star, suggests that Swift J0826.2-7033 may have experienced a thermal time scale mass transfer phase. **[Rawat, Nikita** et al. (including **Pandey, J. C.**). (2024). *Astron. Astrophy., 691,* A264 (10pp)**]**.

## Study of a red clump giant, KIC 11087027, with high rotation and strong infrared excess- evidence of tidal interaction for high lithium abundance

An investigation of the super-Li-rich giant KIC 11087027 was carried out using Kepler photometric light curves and high-resolution spectroscopy to understand the origin of its high lithium abundance **(Figure 6)**. Light curve analysis revealed a rotational period of 30.4 ± 0.1 days, corresponding to a rotational velocity of 19.5 ± 1.7 km $s^{-1}$. Based on its position on the HR diagram, derived value of $^{12}C/^{13}C = 7 \pm 1$ and [C/N] = −0.95 ± 0.2, and asteroseismic parameter it was classified as a low-mass red clump giant in the He-core burning phase. Radial velocity variation from Gaia data suggested that it is an unresolved binary system. The high rotation is likely due to tidal synchronization after a He flash, which significantly reduces the star's size. The unusual combination of rapid rotation, extreme Li enrichment, a strong dust shell, and flares suggest a recent He flash in a tidally locked binary. The findings raise the question whether binary interaction and the resulting high rotation are necessary for the significant Li enhancement observed during or shortly after a He flash. **[**Singh, Raghubar et al. (including **Pandey, Jeewan C.**). (2024). *Astrophy. Jr. Letters, 971: L3* (26 pp.)**]**.

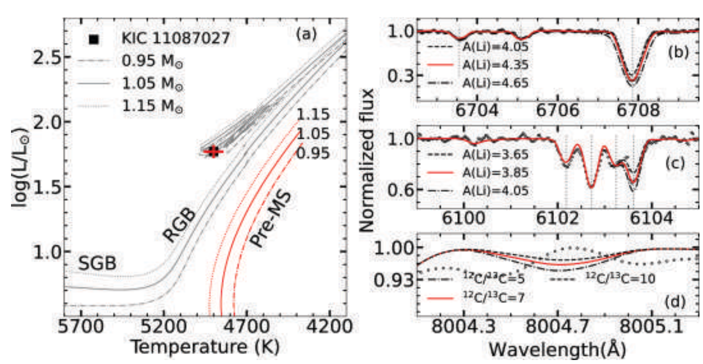



*Figure 6. Location of KIC 11087027 (solid square) in the H-R diagram along with MESA-MIST evolutionary tracks for [Fe/H] = −0.55 dex with different masses. Panels (b), (c), and (d) are the spectral synthesis of Li resonance lines at 6707 Å, Li subordinate line at 6103 Å, and CN red line band near 8004 Å, respectively.*

## Asteroseismology of the mild Am δ Scuti star HD118660

An asteroseismic study of a chemically peculiar (mild Am) star HD 118660 (TIC 171729860) exhibiting δ Scuti pulsations, was carried out. Ground and space-based photometry along with medium and high-resolution spectroscopy were utilised in the study. Based on the TESS time-series photometric data **(Figure 7)**, amplitude modulation was discovered. The pulsational variability was theoretically modelled to determine the role of core overshooting in the seismic activity of this star. The basic seismic parameters were also derived. **[Sarkar, Mrinmoy & Joshi, Santosh** et al. (2024). *Mon. Not. Roy. Astron. Soc, 534 (4),* 3211-3220**]**.

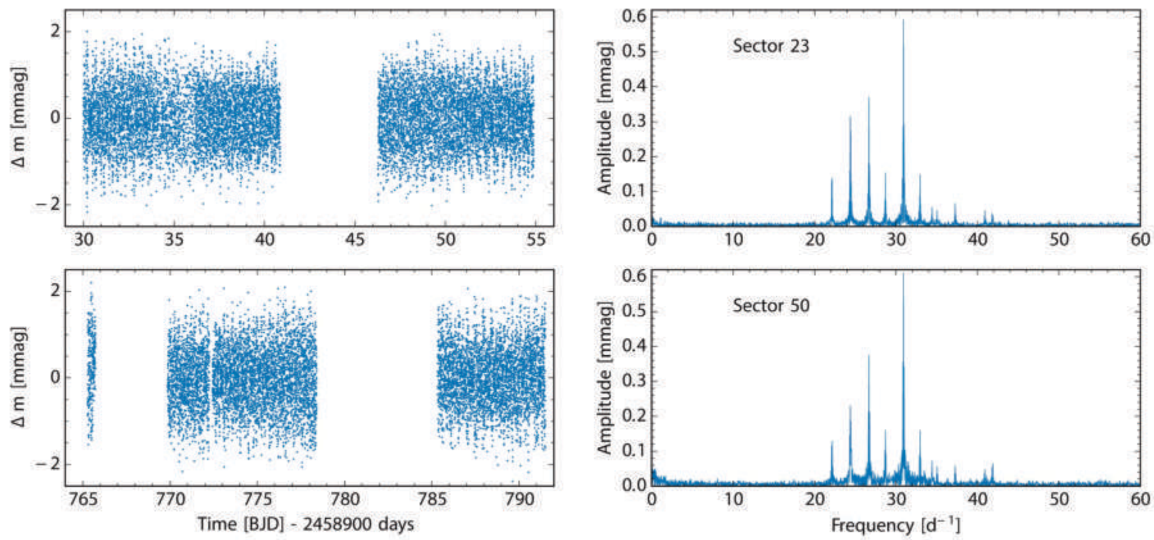



***Figure 7.*** *Top row: The left panel displays the TESS light curve observed in short cadence mode (2-min sampling) in sector 23, and its corresponding Fourier transform is given in the right panel. Bottom row: Idem, but for the data obtained in TESS sector 50.*

## Detection of optical flares in young brown dwarfs

Ground and spaced based photometry from 1.3m DFOT and TESS respectively were combined to study young brown dwarfs (a type of low mass failed stars) in the Taurus star-forming region in the Perseus molecular cloud **(Figure 8)**. Time-resolved variability analysis of CFHT-BD-Tau 3 and CFHT-BD-Tau 4 revealed orbital periods of ~0.96 days and ~3 days respectively. Two superflares in TESS data for CFHT-BD-Tau 4 were detected, whose estimated energies are $7.09 \times 10^{35}$ erg and $3.75 \times 10^{36}$ erg. A magnetic field of ~3.39 kG is required to generate such flare energies on this BD. **[Ghosh, Samrat** et al. (including **Joshi. S. & Lata, Sneh**). (2025). *Astroph. Jr., 981,* 75 (23pp)**]**.

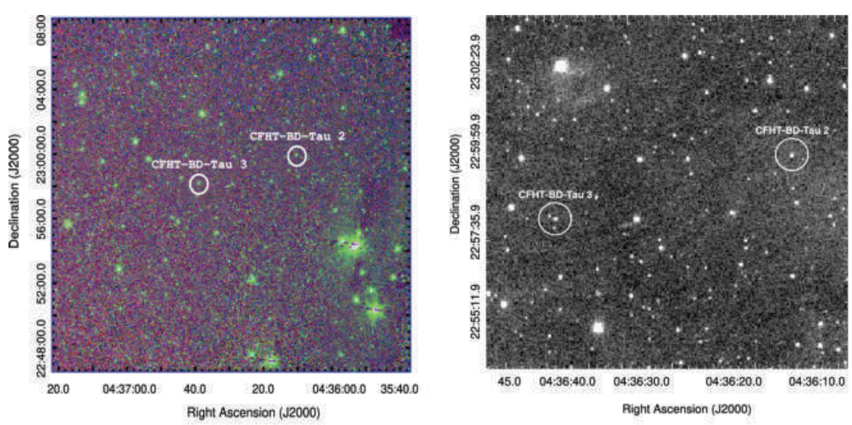



***Figure 8.*** *Left: Spitzer-IRAC color composite image of the 20 × 20 arcmin² region showing CFHT-BD-Tau 2 and CFHT-BD-Tau 3 generated with IRAC 3.6 µm (blue), IRAC 4.5 µm (green), and IRAC 8.0 µm (red). The studied objects are marked with white circles. Right: An image of I-band observations showing CFHT-BD-Tau 2 and CFHT-BD-Tau 3 with 1.3 m DFOT.*

## Foreground dust properties towards the cluster NGC 7380

Using imaging polarimetry with a 104 cm telescope, the polarization of stars lights in four bands were measured to probe the foreground dust toward the embedded cluster NGC 7380 and its associated H II region Sh 2-142. The observed polarization vectors were predominantly aligned with the Galactic magnetic field as shown in **Figure 9**. A region of enhanced dust density in the east and southeast was detected which is corroborated by extinction maps. The data analysis indicated that both polarization and extinction increase with distance, suggesting a dust layer at a distance ~1.2 kpc. The average value of maximum polarization and corresponding mean value of wavelength were 1.71% ± 0.57% and 0.56 ± 0.07 μm, respectively. This is consistent with typical diffuse interstellar dust grains. An inverse correlation between polarization efficiency and visual extinction was also noticed. These observational findings are in agreement with the radiative torque alignment theory for dust grains. **[Singh, Sadhana, Pandey, Jeewan C.** et al. (including **Panwar, Neelam**). (2024). *Astron. Jr., 167*: 242 (16 pp)**]**.

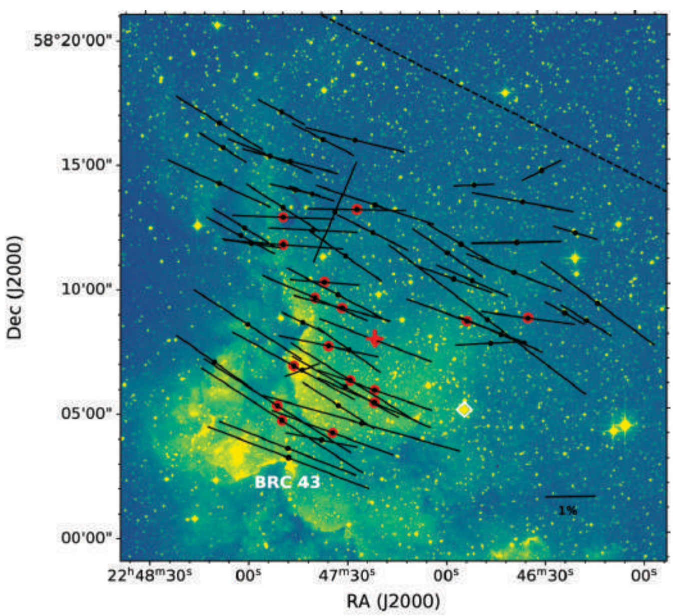



***Figure 9.*** *Polarization vectors are overplotted over the DSS image of the observed region. The length of the polarization vectors corresponds to the polarization value, whereas their orientation reveals the POS magnetic fields along the line of sight toward the stars. The magnetic fields toward these stars are essentially parallel to the Galactic magnetic field.*

## A chemodynamical analysis of bright metal-poor stars from the HESP-GOMPA survey: indications of a non-prevailing site for light r-process elements

A sample of 11 metal-poor stars with [Fe/H] = −1.65 to −3.0 was studied to understand detailed chemical abundances. The study provided measurements for a broad range of elements, including C, Na, Mg, Al, Si, Ca, Sc, Ti, Cr, Mn, Fe, Co, Ni, Cu, Zn, Sr, and Ba, with brighter stars offering access to even more elemental data. Abundance analysis of a highly r-process-enhanced star showed a predominantly main r-process signature and variations in the lighter r-process elements **(Figure 10)**. These stars exhibit a consistent odd-even nucleosynthesis pattern that aligns with predictions for their metallicities, suggesting Type II supernovae as likely progenitors. **[**Bandyopadhyay, Avrajit et al. (including **Pandey, Jeewan C.**). (2024). *Mon. Not. Roy. Astron. Soc.,* 529, 2191-2207**]**.

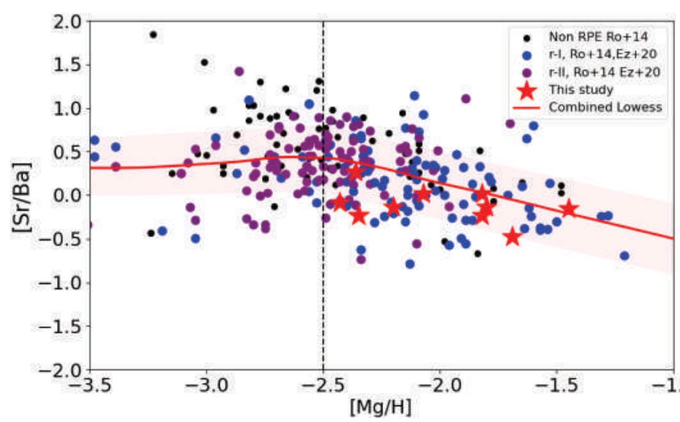



***Figure 10.*** *The ratio of [Sr/Ba] decreases as [Mg/H] increases (red line), which is interpreted as a decrease in the production of light r-process with the increasing contribution from Type II supernovae.*

## AB Dor: coronal imaging and activity cycles

Long-term X-ray monitoring of the rapidly rotating active star AB Dor revealed significant short-term variability dominated by frequent flaring and long-term cycles. It was noticed that AB Dor flares with an average time of 57 ± 23 % of its observing time. Analysis of flare-free data showed rotational modulation, allowing us to image the corona. A light curve inversion technique (LICT) to image stellar coronae of single active fast rotators was developed.

The coronal images obtained from the X-ray light curve modelling showed the bimodal distribution of active regions across the longitudes for most of the epochs. The two identified prominent active regions were found to be separated by ~180° in longitude, which exhibit both longitudinal migration and brightness variations. **Figure 11** shows the coronal image of the AB Dor along with the folded light curve. The long-term (1979-2022) X-ray data suggests a ~19.2-year cycle (and its harmonic), reminiscent of solar activity, alongside potential ~3.6 and ~5.4-year periodicities indicative of an X-ray flip-flop cycle, consistent with optical observations. **[Singh, Gurpreet & Pandey, J. C.** (2024). *Astrophys. Jr., 966*: 86 (14 pp)**]**.

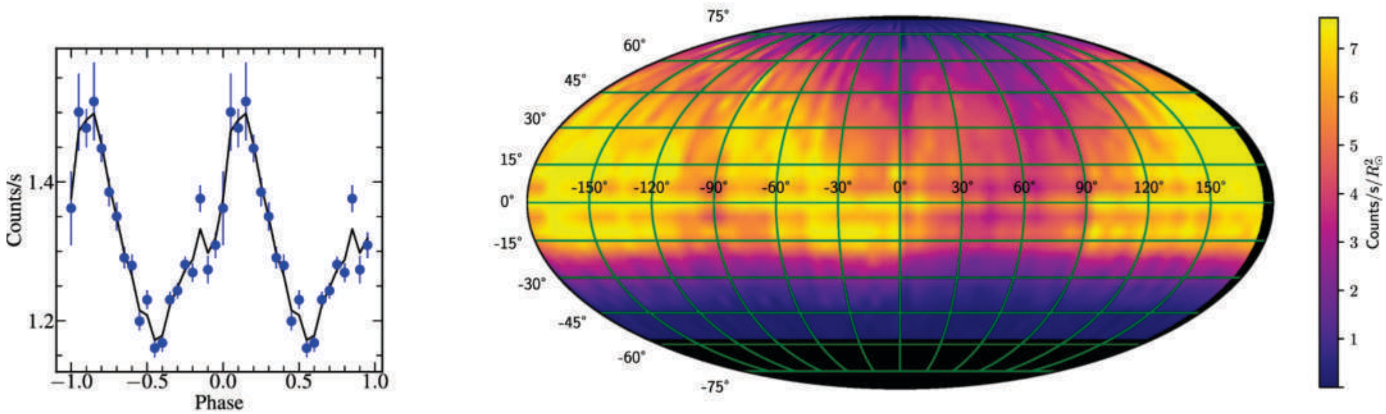



***Figure 11.*** *Left: Phase-folded X-ray light curve. Right. Coronal image as obtained from the light curve inversion technique.*

## Colliding winds from massive O- And WR stars

Winds from massive O type and Wolf Rayet (WR) stars are known to be responsible for X-ray emission arising from wind plasma heated by the strong shocks up to temperatures of 106 –107 K in the case of colliding wind binaries. The X-ray data obtained from XMM-Newton and NuSTAR spanning over more than 19 years of massive O+O binary HD 93250 showed that the variability timescale of the X-ray emission from GD 93250 is 193.8±1.3 d, which is in full agreement with the 194.3±0.4 d period derived from the astrometric orbit. The X-ray spectrum of HD 93250 is well explained by a three-temperature thermal plasma emission model with temperatures of 0.26, 1.0, and 3.3 keV. As shown in **Figure 12**, the X-ray emission from the colliding wind region exhibits an inverse dependence on the stellar separation (D), suggesting a fully adiabatic cooling regime within the wind collision region. The derived plasma temperatures, pronounced phase-locked X-ray variability, and substantial X-ray over-luminosity unequivocally indicate that the colliding wind region is the primary source of X-ray emission from HD 93250.

Whereas the X-ray spectrum of a WR star, WR 48-6 is well explained by a two-temperature plasma model, with cool and hot plasma temperatures of 0.8 keV and 2.86 keV. No significant X-ray variability is observed

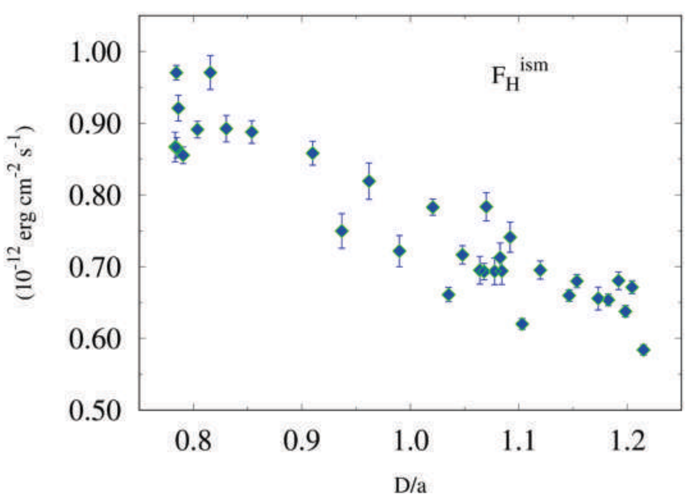



***Figure 12.*** *Variation of the ISM-corrected X-ray flux in 2.0–10.0 keV energy range from HD93250 obtained after X-ray spectral fitting as a function of the binary separation (D normalized to semi-major axis "a").*

during these two epochs of observations. However, an increase in the local hydrogen column density accompanied by a decrease in the intrinsic X-ray flux between two epochs of observations is seen. Additionally, the intrinsic X-ray luminosity is found to be more than $10^{33}$ erg/s during both epoch of observations. The present analysis suggests that WR 48-6 is a promising colliding wind binary candidate with a possible companion of spectral type O5–O6. Current analysis supports the idea that X-ray time analysis of massive stars constitutes a relevant tool for investigating their multiplicity. [Arora, Bharti, De Becker, Michaël & **Pandey, Jeewan C.** (2024). *Astron. & Astrophys., 687*: A34, (13pp).; Jadoliya, Vishal, **Pandey, Jeewan C.**, Tej, Anandmayee. (2025). *Jr. Astrophy. Astron., 46,* 16 (12pp)].

## Characterizing flares from solar type stars V711 Tau and V895 Tau

The energetic X-ray flaring activity of the active RS CVn binaries V711 Tau (=HR 1099) and V895 Tau has been investigated using data obtained from the XMM-Newton observatory. The flare duration ranges from 2.8 to 4.1 hr, with e-folding rise and decay times in the range of 15 - 38 minutes and 1.3 – 2.4 hr, respectively, indicating rapid rise and slower decay phases. The flare frequency for V711 Tau is one flare per rotation period. Time-resolved spectroscopy reveals peak flare temperatures in the range of 32 to 40 MK, emission measures of $10^{53.1}$ -$10^{54.9}$ $cm^{-3}$, global abundances of 0.25 - 0.6 in terms of solar abundances **(Figure 13)**, and peak X-ray luminosities of $10^{30.5}$– $10^{32.3}$ erg/s. The quiescent state of V711 Tau is modelled with a three-temperature plasma maintained at 3.02, 6.96, and 12.53 MK, whereas in the case of V895 Tau the quiescent state corona is well explained by two temperature plasma with temperatures of 3.9 and 11 MK. Being a typical solar analogue, the flare from V895 Tau exhibits a flare which is 600 times more energetic than X10 class flares on the Sun. The estimated flare energies, ranging from $10^{35.83}$–$10^{37.03}$ erg, classify flares from V711 Tau as super-flares. The magnetic field strengths of the loops are found to be in the range of 250–450 G. [Didel, Shweta, **Pandey, Jeewan C.,** Srivastava, A. K. (2025). *Astron. Jr., 169,* 49 (10pp); **Singh, Gurpreet, Pandey, J. C.,** Yadava, Umesh. (2025). *New Astronomy, 114,* 102295 (7pp)].

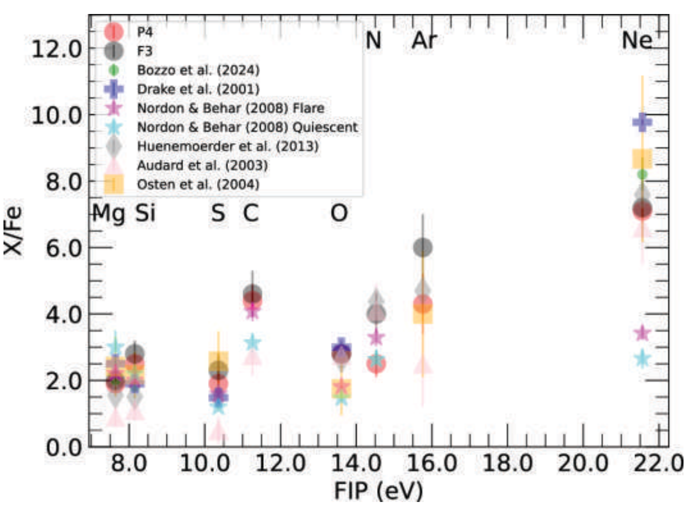



***Figure 13.*** *Elemental abundances relative to Fe are plotted against the first ionization potential.*

## Metallicity relations in LMC and SMC from the slope of red giant branch stars in globular clusters

Deep near-infrared JHK photometry of 23 globular clusters in the LMC and SMC was performed covering a wide range in metallicity (−1.76 < [Fe/H] < −0.32) and age (0.7–14 Gyr). By analysing the red giant

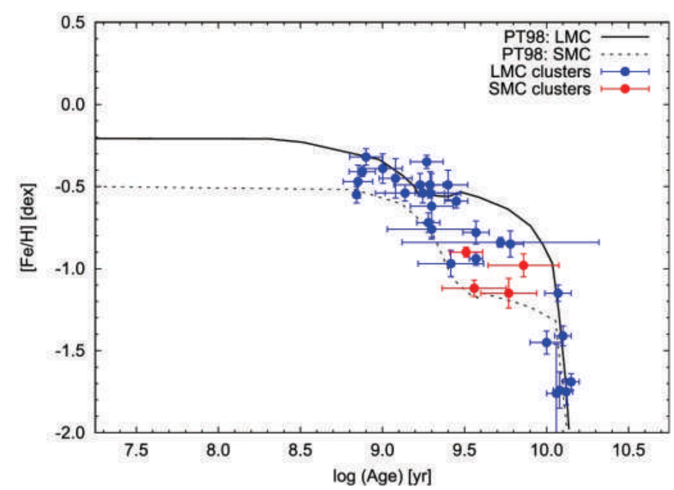



***Figure 14.*** *Log(Age) vs. [Fe/H] (AMR) relation for the present LMC and SMC clusters sample. Blue circles represent LMC clusters, and the red circles represent the SMC sample. The solid and dotted lines correspond to LMC and SMC from the bursting models of Pagel and Tautvaisiene, 1998, MNRAS 299, 235 (PT98).*

branch (RGB) slopes, no significant age dependence was found, but it was observed that young and old clusters occupy distinct regions in RGB slope-metallicity space **(Figure 14)**. Younger clusters show slightly shallower RGB slopes with a negative slope-metallicity correlation, while older clusters display a positive correlation. These results provide valuable insight into the metallicity evolution and stellar population history of Magellanic Cloud globular clusters. [**Sharma, Saurabh** & Borissova, Jura. (2024). *Eur. Phys. Jr. Spec. Top., 233,* 2877–2884].

## Investigating the star-forming sites in the outer galactic arm

The five star-forming sites in the outer Galactic arm viz. AFGL 5157, FSR0807, E70, KPS0620, and IRAS 05331+3115 were investigated to understand the global star formation scenario. The spatial distribution of young stellar objects (YSOs) correlates with regions of high extinction and $H_2$ column density, confirming star formation within dense molecular cores. Two distinct molecular structures were identified, each hosting clusters at different evolutionary stages **(Figure 15)**. AFGL 5157 and FSR0807 exhibit filamentary structures and massive star formation, while KPS0620 and IRAS 05331+3115 are younger and low-mass forming regions. The research findings support the hub–filament model and highlight the diverse star formation mechanisms operating in this complex. [**Verma, Aayushi, Sharma, Saurabh**, et. al. (including **Kaur, Harmeen , Chand, Tarak & Mamta**).(2024). *Astron. Jr., 168:98,* (15pp)].

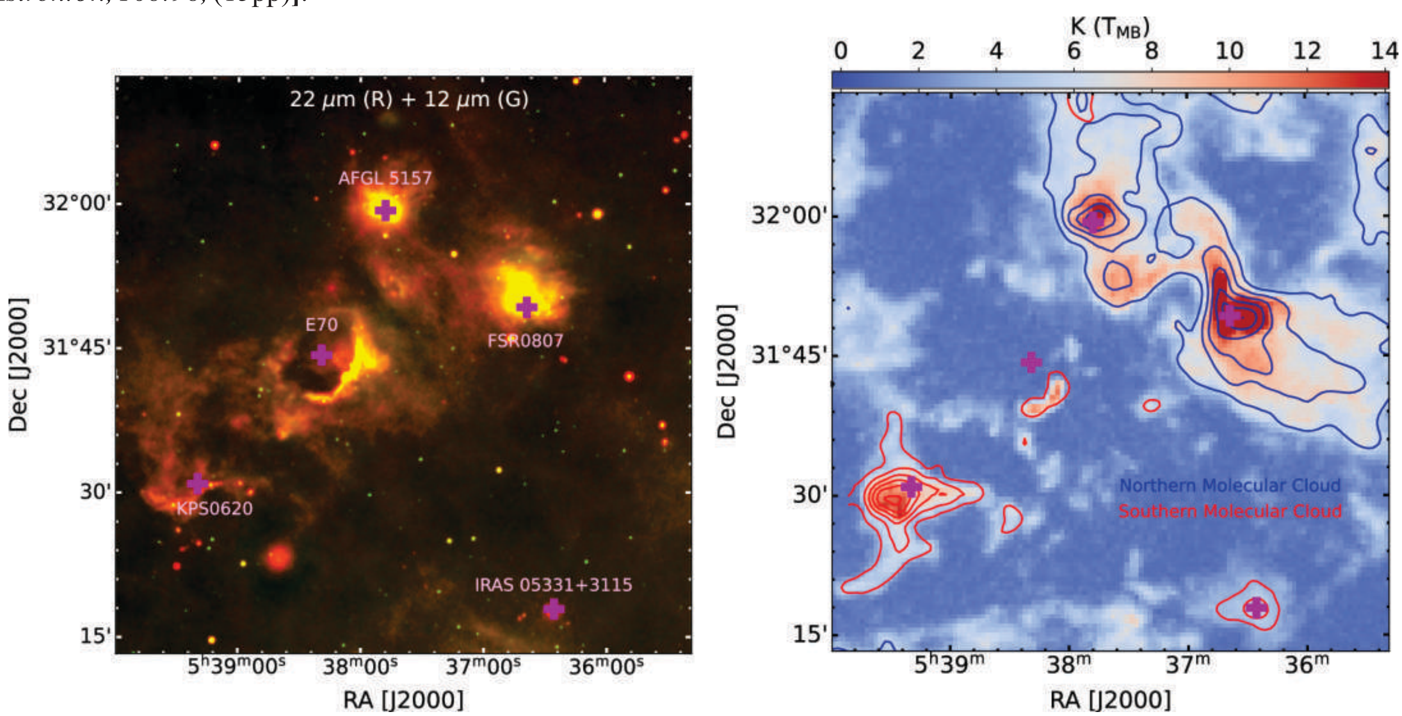



***Figure 15.*** *Left: Colour-composite image (Red: WISE 22 μm; Green: WISE 12 μm) of present 1° × 1° target area. Right: $^{12}$CO peak intensity map of the selected region. The blue and red contours represent the $^{12}$CO moment-0 contours for the northern and southern molecular structures/clouds, respectively. The lowest level value for both the contours is the mean value with a step size of 1σ. The locations of five sites of active star formation are also marked with a magenta '+' marker in both panels.*

Recent advances in infrared, far-infrared, and sub-millimeter instrumentation—notably JWST and ALMA have significantly enhanced the understanding of the interstellar medium (ISM) and star formation. In this white paper, India's contributions to this field and outline priority areas for future focus are reviewed, including the development of observational facilities and theoretical frameworks, to enhance India's global research impact in the coming decades. [Mookerjea, Bhaswati et al. (including **Sharma, Saurabh, Panwar, Neelam** & **Sahu, Dipen**). (2025). *Jr. Astrophy. Astron., 46,* 3 (26pp)].

## Uncovering the hidden physical structures and protostellar activities in the low-metallicity S284-RE region: results from ALMA and JWST

It is the study of a multi-wavelength study of the S284-RE region, a low-metallicity environment within the extended S284 H II region. A thermally supercritical filament (~2402 $M_\odot$, ~8.5 pc) hosts YSOs grouped into three active clusters (YCl1–YCl3), with YCl3 being the most evolved and YCl2 the youngest. JWST ratio maps reveal seven bipolar $H_2$ outflows, ALMA continuum peaks, and YSO positions **(Figure 16)**. Two ALMA sources are potential massive protostar candidates, notably source #2, which drives the prominent ~2.7 pc olc1 outflow, exhibiting Br-α, PAH emission, and episodic accretion signatures. **[**Jadhav, O. R., Dewangan, L. K., **Verma, Aayushi**, Bhadari, N. K., Maity, A. K., **Sharma, Saurabh, Mamta**. (2025). *Astroph. Jr., 980,* 133 (14pp)**]**.

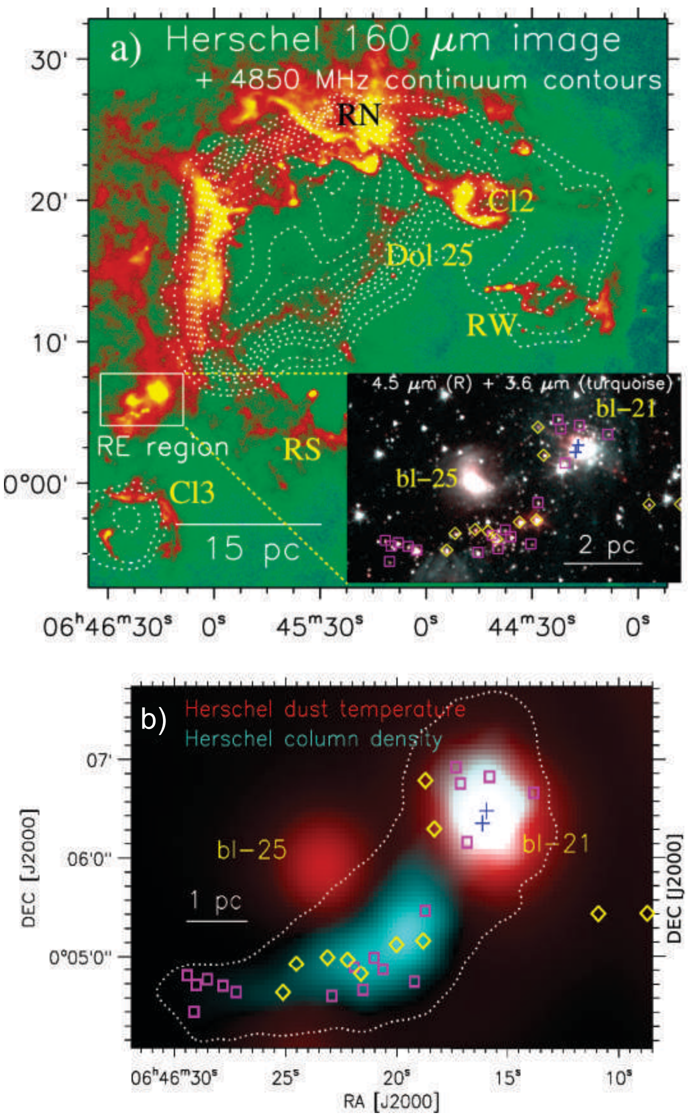



***Figure 16****. (a) Overlay of the 4850 MHz radio continuum emission contours on the Herschel 160 μm image of the large H II region S284. (b) The panel shows a two-color composite map made using the Td map (in red) and N (H2) map (in turquoise) overlaid with the positions of Class I YSOs (diamonds) and Class II YSOs (squares).*

## A hub–filament system with an infrared bubble at the hub centre

A multiwavelength, multiscale study of the Mon R2 hub–filament system (HFS), uncovering a spiral structure with a massive central hub fed by multiple accreting filaments was conducted. ALMA $C^{18}O$ (1–0) observations reveal a molecular ring (~0.18 × 0.26 pc) enclosing an IR ring (~0.12 × 0.16 pc), hosting embedded sources including massive stars IRS 1 and IRS 2. A prominent B-shaped expanding structure, seen in ALMA HNC(3–2) data **(Figure 17 & 18)**, and braid-like substructures suggest instabilities in photon-dominated regions. High-pressure feedback (~$10^{-8}$ to $10^{-10}$ dyn $cm^{-2}$) from massive stars appears to shape the rings, indicating Mon R2's transition from an IR-quiet to IR-bright phase driven by gas accretion and stellar feedback. **[**Devangan, L. K. et al. (including **Sharma, S.**). (2025). *Astron. Jr., 169,* 80 (18pp)**]**.

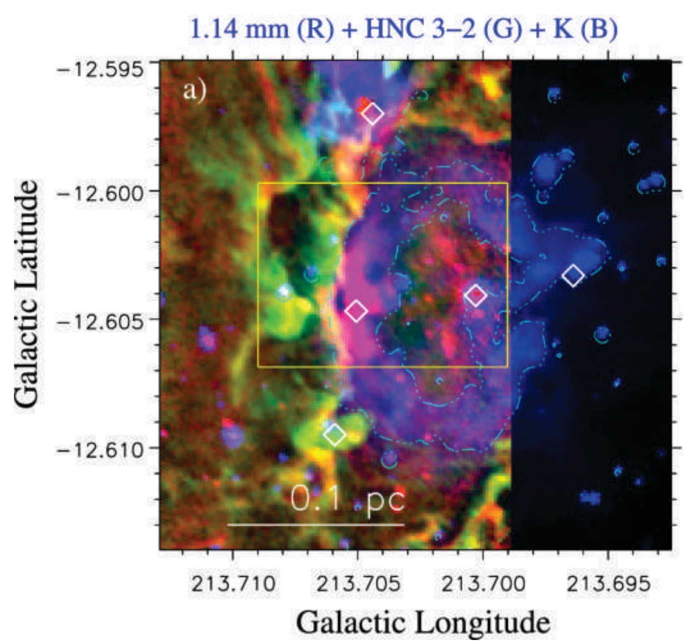



***Figure 17.*** *A three-color composite map produced using the ALMA 1.14 mm dust continuum map (in red), the HNC(3–2) moment-0 map (in green), and the UKIDSS K-band image (in blue).*

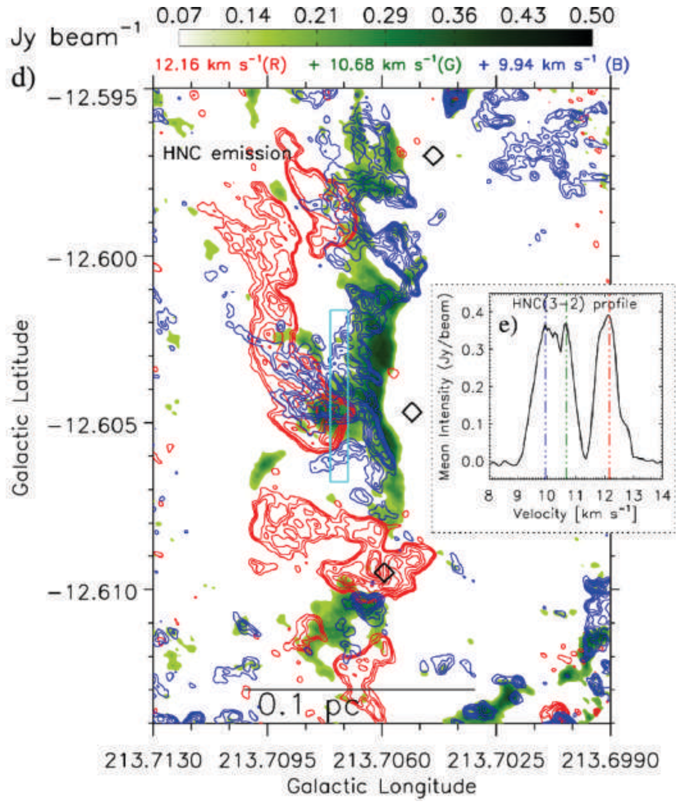



***Figure 18.*** *The ALMA HNC(3–2) filled contour map at 10.68 km $s^{-1}$ (in green) overlaid with contours of HNC(3–2) emission maps at 12.16 km $s^{-1}$ (in red) and 9.94 km $s^{-1}$ (in blue).*

Further, the dense gas kinematics of the G11P1 hub–filament system (HFS) was investigated. The presence of G11P1-HFS (≤0.6 pc) previously identified in JWST NIRCam images was confirmed using ALMA $N_2H^+$(1–0) data **(Figure 19)**. Steep on-sky velocity gradients (±5–7 km $s^{-1}$ $pc^{-1}$) and their alignment with gravitational vectors indicate gravity-driven inflow along filaments. The system exhibits a wiggled, funnel-like morphology in position–velocity space, suggesting the role of sub-filaments or transverse gas flows in channeling mass toward the hub, crucial for early high-mass star formation. **[**Bhadari, N. K. et al. (including **Sharma, S.**). ( 2025). *Astron. Astrophy., 694,* L18 (8pp)**].**

## G321.93-0.01: a rare site of multiple Hub-filament systems with evidence of collision and merging of filaments

A multiwavelength, multiscale study of the molecular cloud G321.93–0.01 was performed to understand the role of hub–filament systems (HFSs) in massive star formation (MSF). Using $^{13}CO$(J = 2–1) data, three HFSs: HFS-1, HFS-2 were identified, and a candidate HFS (C-HFS). Both HFS-1 and HFS-2 exhibit high mass accretion rates (>$10^{-3}$ $M_\odot$ $yr^{-1}$). Hub-1, being more massive, shows evidence of ongoing MSF, with three compact H II regions and low-mass ALMA cores **(Figure 20)**. C-HFS also hosts a compact H II region, indicating a similarly evolved stage. In contrast, Hub-2, despite active accretion, lacks radio emission, suggesting an earlier evolutionary stage. Formation mechanisms differ: HFS-1 likely formed via filament–cloud collision, while HFS-2 and C-HFS likely formed through filament merging. **[**Maity, A. K. et al. (including **Sharma, S.**). (2025). *Astron. Jr., 169,* 56 (20pp)**].**

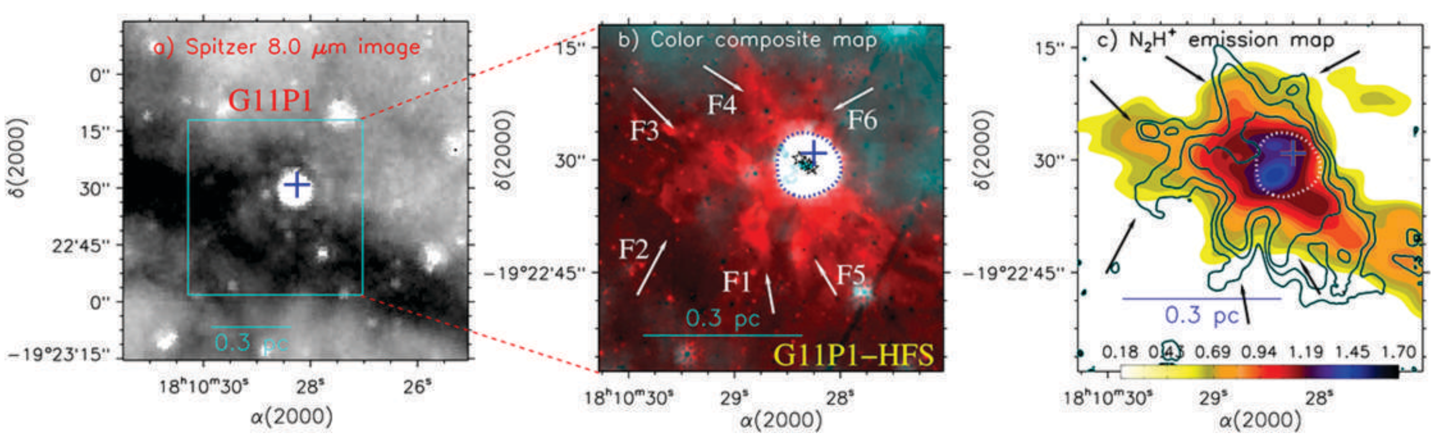



***Figure 19.*** *Morphology of G11P1-HFS seen in the Spitzer, JWST, and ALMA observations. (a) Spitzer 8 μm image. (b) Two-colour composite map made of the JWST ratio map (F444W/F356W; inverted scale in red) and Spitzer 8 μm (cyan) emission. (c) ALMA $N_2H$+(1–0) integrated emission map overlaid with the footprints of structures seen in the JWST ratio map.*

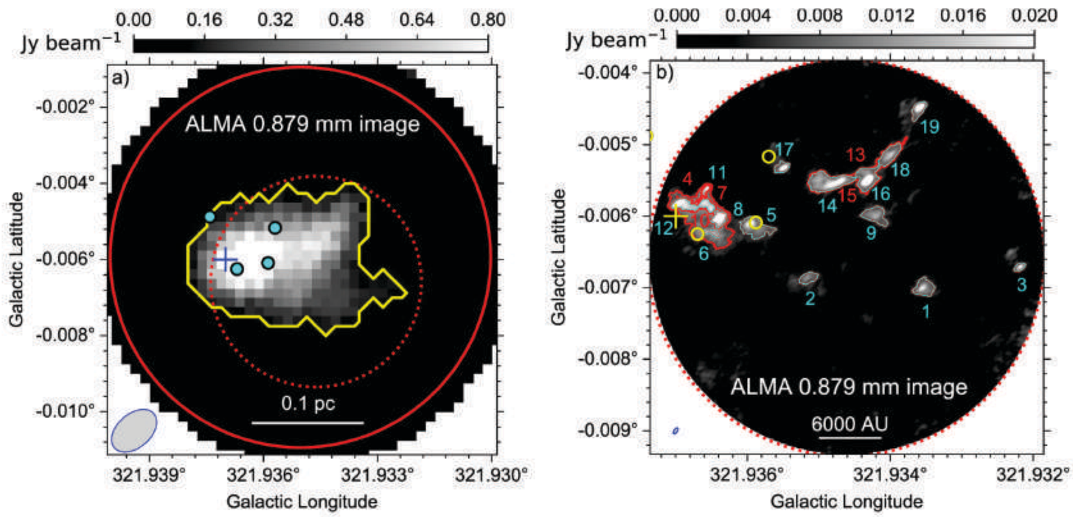



*Figure 20.* *(a) ALMA Band-7 continuum image (beam size ~ 4."9 × 3."1) obtained with ALMA 7 m array. The yellow contour presents the astrodendro-identified structure. The area under the dotted red circle is further zoomed-in in panel (b). (b) Zoomed-in view of the target area using ALMA Band-7 continuum image of beam size ~0.33" × 0."16 obtained with ALMA 12 m array. The astrodendro-identified structures, i.e., the branches and leaves, are marked in colors red and cyan, respectively. In panels (a) and (b), the plus symbol indicates the position of the 22 GHz $H_2O$ and Class I 95 GHz $CH_3OH$ MASER emissions, and the circles represent Class I YSO candidates. The ellipses in the bottom-left corners of panels (a) and (b) indicate the beam size of the data.*

## A deep near-infrared view of a newly hatched cluster in giant molecular cloud G148.24+00.41

We conducted a deep near-infrared study of an embedded cluster located in the hub of the giant molecular cloud G148.24+00.41 (~$10^5$ $M_\odot$) using TANSPEC on the 3.6m Devasthal Optical Telescope. Observations of the central 2 pc × 2 pc region **(Figure 21)** revealed a young cluster (~0.5 Myr) with a current mass of ~180 $M_\odot$ and a star formation rate of ~330 $M_\odot$ $Myr^{-1}$, yielding a star formation efficiency of ~20%. The cluster, situated in the cloud's most massive clump and connected to a filamentary gas network, is likely to evolve into a richer cluster over the next few million years. [Rawat, V. et al. (including **Kumar, Brajesh** & **Sharma, S.**). (2024). *Astron. Jr., 168,* 136 (14pp)].

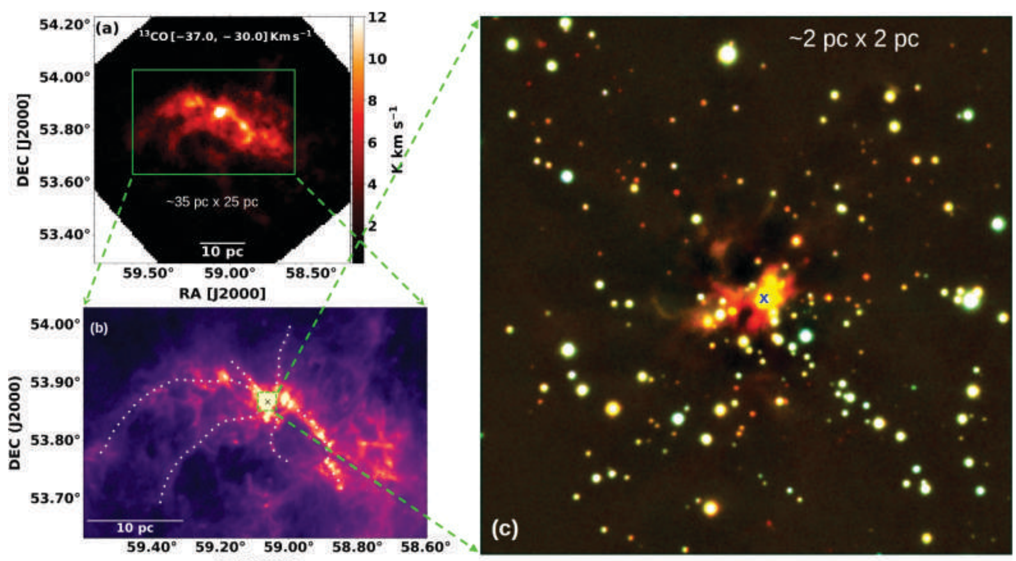



*Figure 21.* *(a) $^{13}$CO molecular gas distribution of G148.24+00.41. The green solid box shows the inner cloud region zoomed-in (b). (b) Herschel 250 µm image of the inner cloud region of size ~35 pc × 25 pc, along with small-scale filamentary structures adopted from Rawat et al. (2023). The green dashed box shows the hub region of size ~2 pc × 2 pc, observed with TANSPEC. (c) NIR color-composite image of FSR 655 as seen by TANSPEC. The location of the massive YSO is shown by a cross symbol.*

## Low-mass stellar and substellar content of the young cluster Berkeley 59

To characterize the low-mass (sub) stellar population in a sample of massive young clusters, a sample of young star clusters/star-forming regions was selected. A multi-wavelength analysis of the young star cluster Berkeley 59 based on the Gaia data and deep infrared (IR) observations was conducted with the 3.58-m Telescopio Nazionale Galileo and Spitzer space telescope. The kinematic distance of the cluster, ~1 kpc, agrees with previous photometric studies. The NIR data is the deepest available near-IR observations for the cluster so far, and it has reached below 0.03 $M_\odot$. The mass function of the cluster region is calculated using the statistically cleaned color-magnitude diagram and is similar to the Salpeter value for the member stars above 0.4 $M_\odot$. In contrast, the slope becomes shallower ($\alpha \sim 0.99$) in the mass range 0.04 - 0.4 $M_\odot$, comparable to other nearby clusters. The spatial distribution of young brown dwarfs (BDs) and stellar candidates shows a non-homogeneous distribution **(Figure 22)**. This suggests that the radiation feedback from massive stars may be a prominent factor contributing to the BD population in the cluster Be 59. The star-to-BD ratio for the cluster was also estimated, which is found to be ~3.6. The Kolomogorov-Smirnov test shows that stellar and BD populations significantly differ, and stellar candidates are near the cluster centre compared to the BDs, suggesting mass segregation in the cluster toward the substellar mass regime. **[Panwar, Neelam , Rishi, C.**, et. al. (including **Sharma, Saurabh**). (2024). *Astron. Jr., 168*:89, (12pp)**]**.

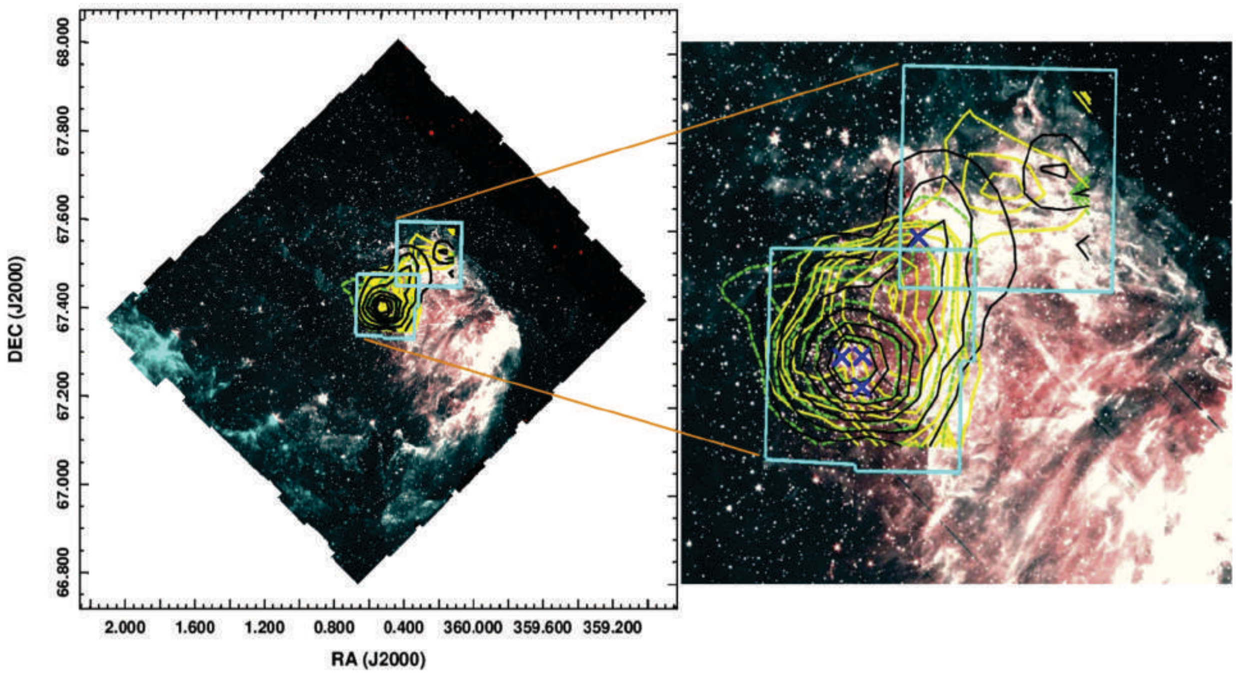



***Figure 22.*** *Colour-composite image (turquoise: Spitzer 3.6 and red: 4.5 μm) of Be 59. The regions covered with the NICS observations are shown with the cyan polygons. The black contours show the density distribution of the YSO candidates. The cross symbols mark the locations of the massive O-type stars. The dashed green and thick yellow contours show the surface density distributions of the young stellar (0.075–0.9 Me) and BD (<0.075 Me) candidates, respectively.*

## Star formation exists in all early-type galaxies - evidence from ubiquitous structure in UV images

The origin of ultraviolet (UV) emission in early type galaxies (ETGs) was investigated by comparing their UV and optical morphologies using structural parameters (concentration, asymmetry, clumpiness, Sérsic index) for a sample of 32 ETGs ($z < 0.03$). While optical images appear smooth due to dominance by old stars, UV images exhibit significant structure with higher asymmetry and clumpiness, and lower Sérsic indices **(Figure 23)**. These results are consistent across stellar mass, colour, and interaction status. The findings indicate that the UV emission in ETGs is primarily due to young stars, confirming widespread ongoing star formation in ETGs in the local Universe. **[Pandey, Divya**, Kaviraj, Sugata, Saha, Kanak & **Sharma, Saurabh**. (2024). *Mon. Not. Roy. Astron. Soc., 531,* 2223-2236**]**.

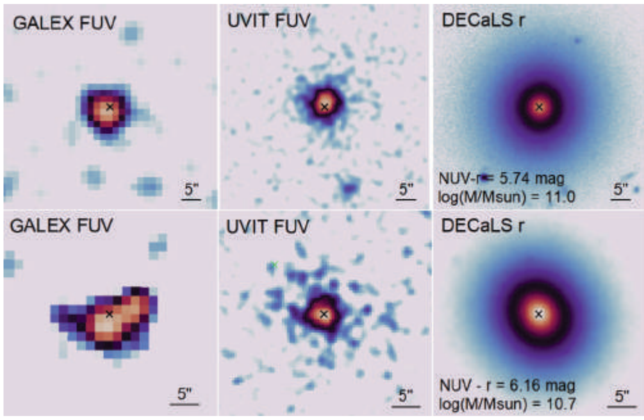



***Figure 23.*** *GALEX FUV, UVIT FUV, and DECaLS r-band images of two galaxies. The black crosses represent the optical centroids of each galaxy. The GALEX–SDSS (NUV-r) colour and the stellar mass of each galaxy is indicated on the images. Each panel represents the same region for each galaxy.*

## Accretion funnel reconfiguration during an outburst in a young stellar object: EX Lupi

The 2022 accretion-driven outburst of EX Lupi, a low-mass young stellar object was studied which showed a sudden phase shift (~112° ± 5°) in its periodically oscillating multi-band light curves. High-resolution spectra from SALT-HRS revealed a consistent phase shift in radial velocities (RVs) and an increased RV amplitude in emission lines, indicating a reconfiguration of the accretion funnel and a change in the hotspot's position on the stellar surface. 3D magnetohydrodynamic simulations reproduce this phase change, suggesting either a forward shift of the dipolar funnel or emergence of a new accretion stream. Additional evidence of azimuthally asymmetric hotspots and clumpy accretion was found in both photometric and spectroscopic data. [Singh, Koshvendra et al. (including **Ghosh, Arpan** & **Sharma, Saurabh**). (2024). *Astrophys. Jr., 968:* 88, (28pp)].

# Extragalactic Astronomy

*In this research area, multiwavelength observations are key to investigating the variability of Active Galactic Nuclei (AGN) across multiple wavelengths, including optical, X-ray, gamma-rays, and radio bands. This comprehensive approach provides insights into the complex emission mechanisms of AGN, helping to understand the nature of relativistic jets, accretion disks, and the environments around supermassive black holes. Multimessenger research on transients, such as Supernovae, Gamma-Ray Bursts (GRBs) and Tidal Disruption Events (TDEs) are also carried out to understand the energetic processes involved in these extreme phenomena.*

## Contrasting explosion characteristics in Type II supernovae

Comprehensive optical photometric and spectroscopic analyses of two hydrogen-rich Type II supernovae SN 2019nyk, a fast-declining Type II event, and SN 2018is, a low-luminosity Type IIP SN were carried out. Together, these events underscore the diversity in Type II supernovae, spanning differences in progenitor mass, explosion energy, and CSM interaction. SN 2019nyk shows a rapid decline rate of 2.84 ± 0.03 mag $(100\ d)^{-1}$ in the V band following a peak absolute magnitude of −18.09 ± 0.17 mag **(Figure 24)**. Early-time spectra reveal high-ionisation emission features and narrow Balmer lines up to ~4 days post-explosion, indicative of circumstellar material (CSM) interaction. A comparison of these features with other Type II SNe displaying an early interaction reveals similarities between these features and those observed in SNe 2014G and 2023ixf **(Figure 25)**. Early time spectral and light curve modelling suggests a progenitor mass-loss rate of $\sim 10^{-3}\ M_{\odot}\ yr^{-1}$ and a total of 0.16 $M_{\odot}$ of CSM within 2900 $R_{\odot}$ of the progenitor. Light curve modelling infers a progenitor mass of 15 $M_{\odot}$ and an explosion energy of $1.1 \times 10^{51}$ erg. [Dastidar, Raya et al. (including **Dukiya, Naveen** & **Misra, Kuntal**). (2024). *Astron. Astrophys., 685:* A44 (18 pp)].

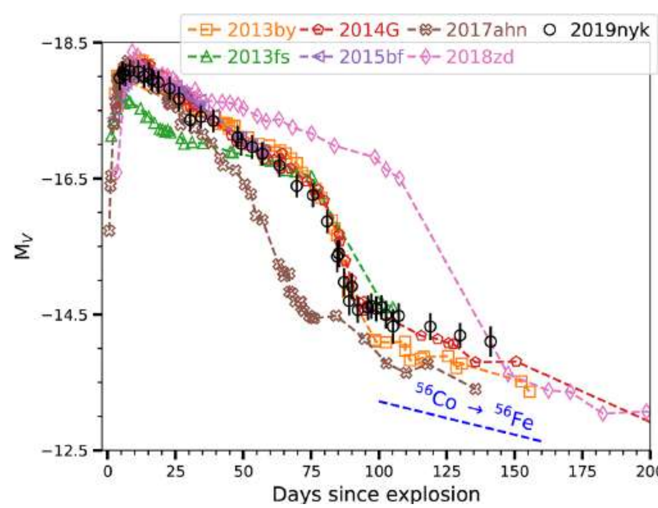



***Figure 24.*** *Comparison of absolute V band LCs of SN 2019nyk with those of the comparison sample. The radioactive decay line assuming full trapping of photons is shown with a dashed line.*

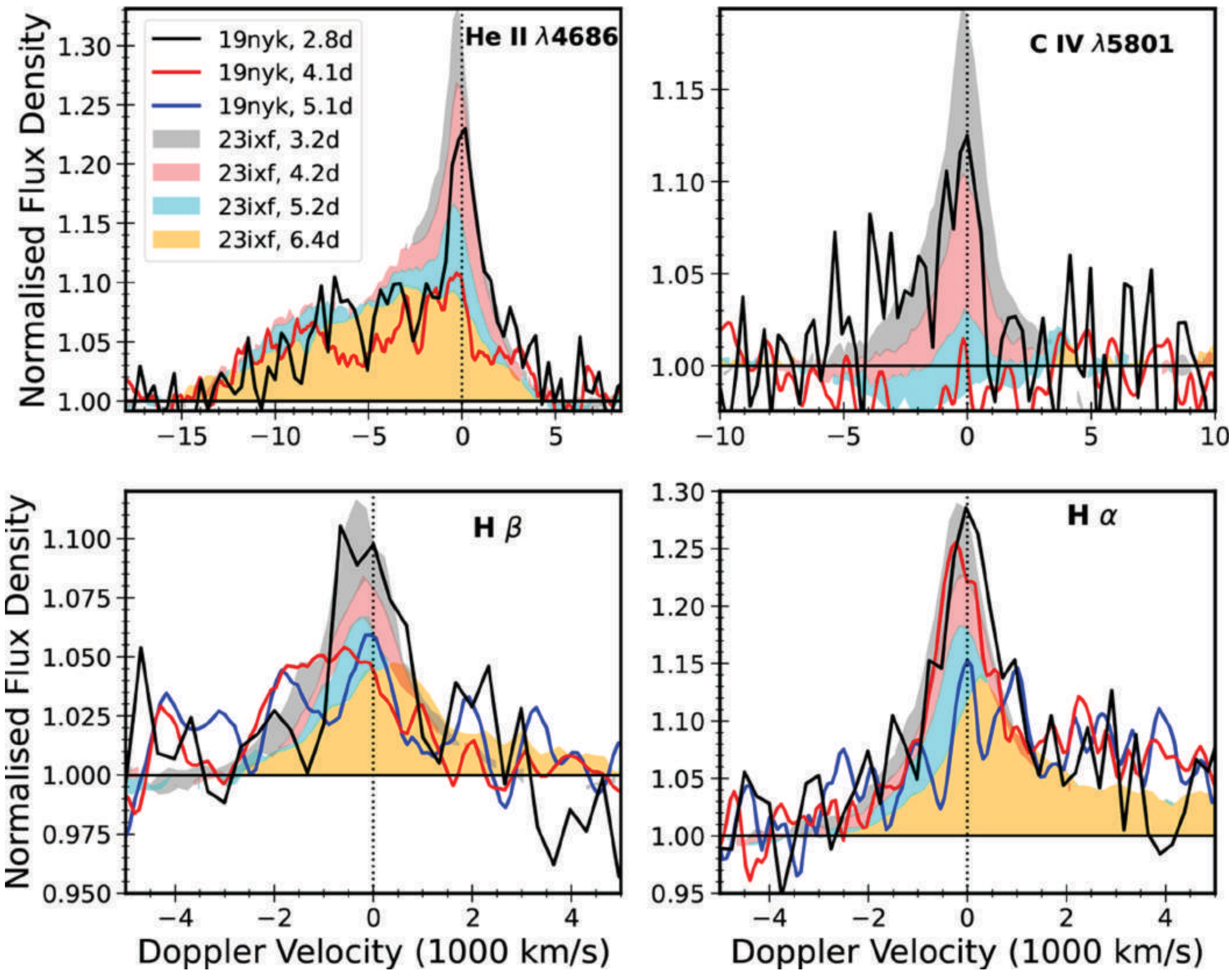



*Figure 25. Comparison of the high ionisation emission lines in the early spectra of SNe 2019nyk and 2023ixf. All the spectra of SN 2023ixf used for comparison in this plot were acquired using ALFOSC and Grism 4 (~13 Å) mounted on the Nordic Optical Telescope, which is comparable in resolution to the spectra of SN 2019nyk used in this plot (~18 Å).*

SN 2018is, in contrast, was characterised by a lower peak luminosity (−15.1 ± 0.2 mag) **(Figure 26)**, slower expansion velocities (~1400 km $s^{-1}$), and narrow hydrogen emission lines, even for a low-luminosity Type II SN. Its recombination phase was short (~110 days) and unusually steep, with spectral features pointing to a moderate-mass progenitor. Modelling suggests a pre-SN mass of ~9.5 $M_\odot$ and a low explosion energy (~0.2–0.4 × $10^{51}$ erg). The nebular spectra show weak [O I] but no clear signatures of electron-capture or Fe-core collapse. As a low-luminosity SN II with an atypically steep decline during the photospheric phase and remarkably narrow emission lines, SN 2018is contributes to the diversity observed within this population. (Dastidar et al. 2025). [Dastidar, R., **Misra, K.** et al. (2025). *Astron. Astrophy., 694,* A260 (18pp)].

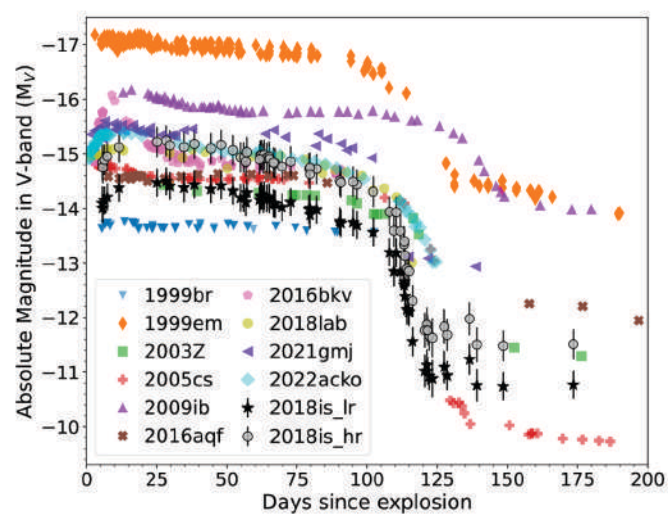



*Figure 26. Comparison of absolute V band light curves of SN 2018is with other SNe II. The magnitudes are corrected for distance and reddening.*

## CSM interaction in supernovae: observational signatures from ASASSN-14il and SN 2021foa

Long-term photometric and spectroscopic studies were conducted on two hydrogen-rich interacting supernovae, ASASSN-14il and SN 2021foa, both characterised by strong signatures of circumstellar material (CSM) interaction. These events highlight the diversity of CSM interaction signatures and the significant roles of geometry, progenitor history, and viewing angle in shaping the observed properties.

ASASSN-14il, located in PGC 3093694, reaches a peak r-band magnitude of about −20.3 mag, rivalling SNe 2006tf and 2010jl. The multiband and pseudo bolometric light curves display a plateau lasting for ~50-day. Spectra reveal narrow Balmer lines dominated by electron scattering, and the early emergence of broad Hα components that suggests asymmetry in the CSM. A late-time blueshift in Hα indicates dust formation, and a mass-loss rate of 2–7 $M_\odot$ $yr^{-1}$ suggest an eruptive luminous blue variable (LBV) progenitor. A cartoon diagram represents the evolution of ASASSN-14il through various distinct phases is shown in **Figure 27**. A dense disk-like CSM is located face-on to the observer, and a low-density CSM is present elsewhere. Interaction with dense CSM gives rise to most of the luminosity. At mid-phases, the photosphere recedes from the pre-shock CSM and signatures from the post-shock region and ejecta are visible. At late times the formation of dust obscures the emission from receding material. **[Dukiya, Naveen** et al. (including **Misra, K. & Ailawadhi, Bhavya**). (2024). *Astrophy. Jr., 976*, 86 (21pp)**]**.

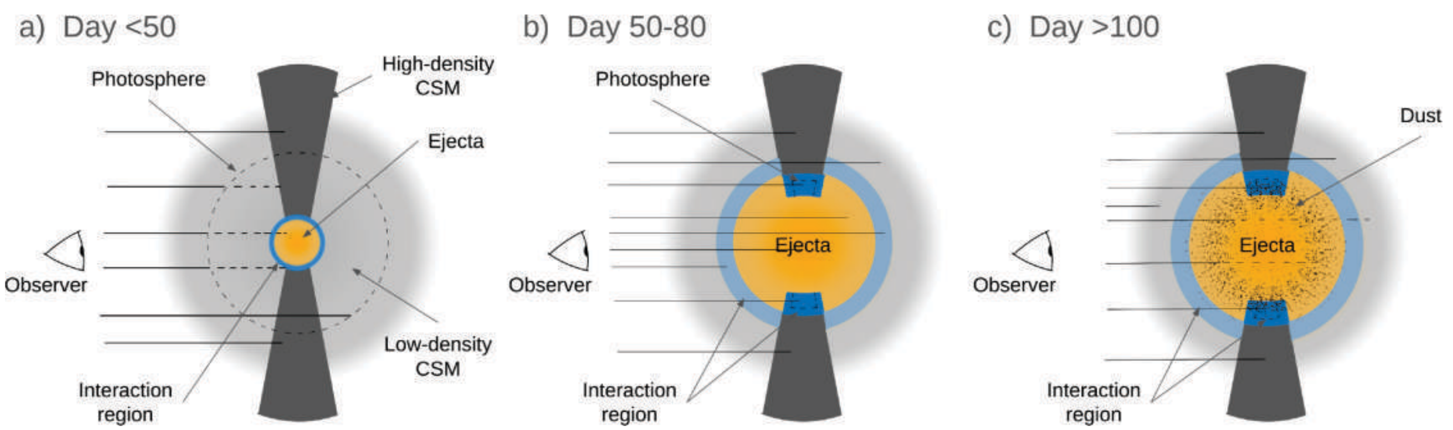



***Figure 27.*** *Cartoon diagram representing the evolution of ASASSN-14il through various distinct phases. Representative lines of sight are shown by solid lines, where dashed lines indicate hindered lines of sight.*

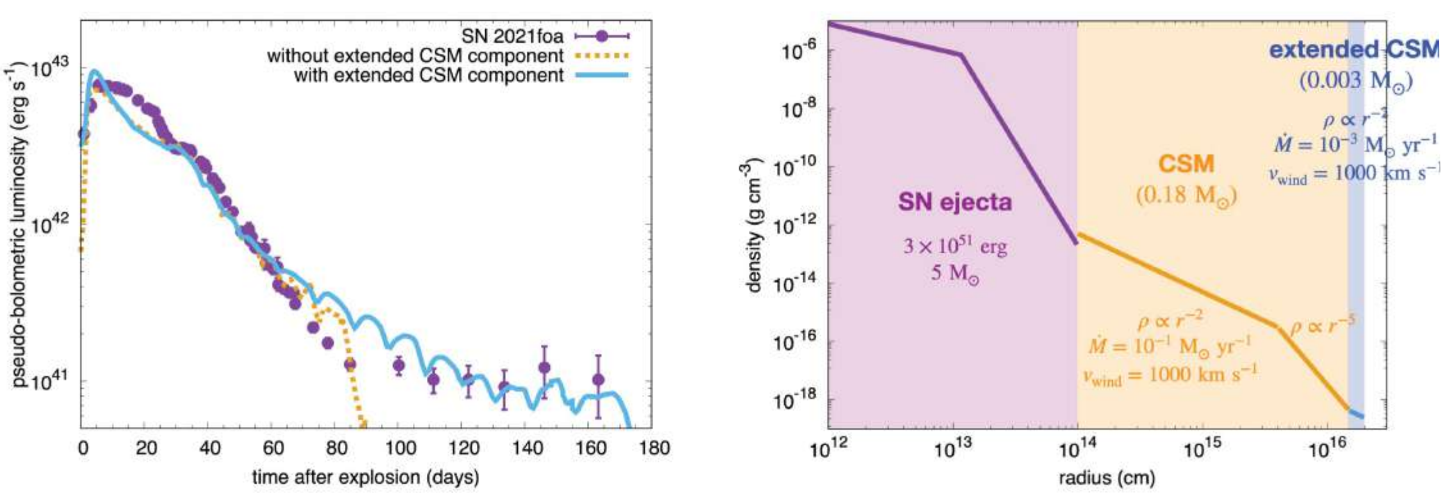



***Figure 28.*** *Left: Bolometric light-curve models. Right: The initial density structure of the models.*

SN 2021foa displays a transitional nature between Type IIn and Ibn SNe, with He I line comparable in strength to Hα near peak. Its spectral evolution shows a shift from IIn-like features pre-maximum to a hybrid IIn/Ibn profile post-maximum. The Hα profile evolution supports a disc-like CSM geometry. The photometric evolution shows a precursor at −50 d and a light curve shoulder around 17 d. The peak luminosity and colour evolution of SN 2021foa are consistent with other Type IIn and Ibn SNe. Hydrodynamical modeling suggests a structured CSM with varying densities and mass-loss rates ($10^{-3}$–$10^{-1}$ $M_{\odot}$ $yr^{-1}$) **(Figure 28)**, possibly due to a transitioning LBV to WR progenitor or binary interaction. **[**Gangopadhyay, Anjasha, **Dukiya, Naveen** et al. (including **Misra, K.**). (2025). *Mon. Not. Roy. Astron. Soc, 537,* 2898–2917**]**.

## Machine learning insights into the binary merger origins of GRBs

The classification of gamma-ray bursts (GRBs) remains a complex challenge in high-energy astrophysics. This work, using Fermi/GBM data and unsupervised machine learning techniques, identified five distinct GRB clusters, a result consistent with our previous work using the Swift/BAT data. The kilonovae associated GRBs were found to lie in two clusters, including GRB 170817A, supporting its origin from a BNS merger, while the other may correspond to NSBH events **(Figure 29)**. **[Dimple, Misra, K.,** & Arun, K. G. (2024 ). *Astrophy. Jr., 974,* 55 (8pp)**]**.

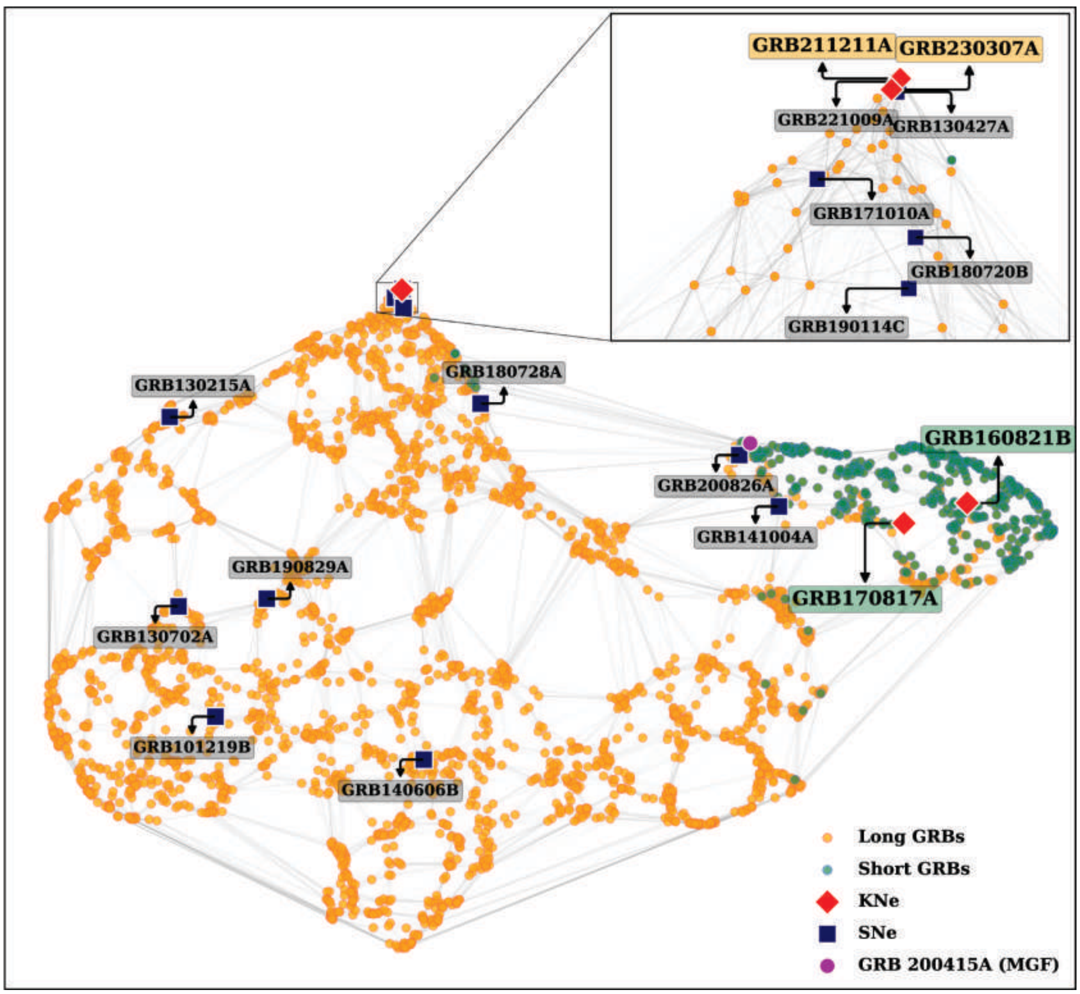



*Figure 29. The connectivity map color coded as traditional long- and short-duration GRBs based on their T90 duration. KN- and SN-associated GRBs are shown with red diamonds and blue squares, respectively, on the embeddings. KN-associated GRBs are labeled with their names and respective colors as per their traditional classification. Short- and long-duration KN-associated GRBs are well separated into two distinct groups. SN-associated GRBs are scattered across the map with an unclear clustering pattern. Notably, several SN- and KN-associated GRBs lie at the top of cluster 2. The inset offers a closer view, revealing that GRBs 211211A and 230307A are adjacent, suggesting similarity in their light curves.*

Additionally, some bright SNe are also situated nearby labelled with their names in grey colour. Assuming these associations, GRB rate estimates from these clusters were found to be consistent with BNS and NSBH merger rates reported by the LIGO–Virgo –KAGRA (LVK) collaboration from the first three observing runs (O1, O2, O3) **(Figure 30)**. These comparisons also allow constraints on the beaming

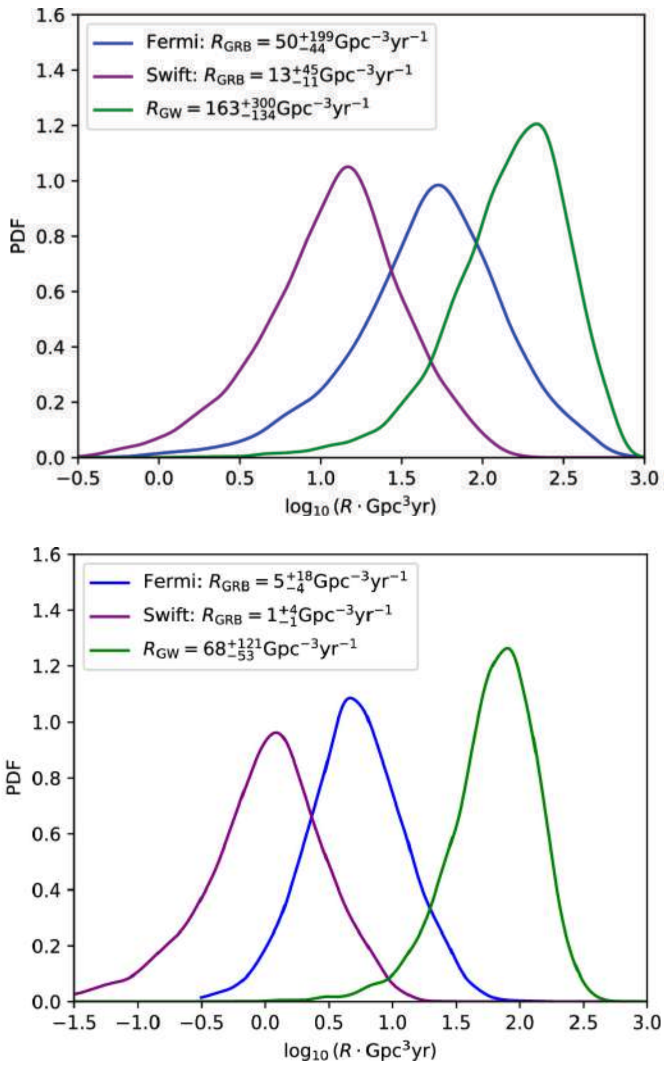



***Figure 30.*** *Top: the posteriors on the rate of GRB-bright BNS mergers, p($R_{GRB}$/$N_{BNS}$), estimated using Fermi data and Swift data. These are both broadly consistent with the GW BNS rate posterior p(RGW\dGW). The 90% rate estimates are quoted on the top-left corner of the panel. The larger error bar on the Fermi rate estimates can be attributed to the larger uncertainty in the fraction of events in the BNS cluster that have a BNS provenance, as compared to the Swift rate estimates. Bottom: same as the left panel but for NSBHs. The Fermi and Swift rate estimates are broadly consistent with each other but are markedly smaller than the GW NSBH rate posterior, as expected.*

angles and the fraction of mergers producing GRBs. For BNS-associated GRBs, the inferred beaming angle lies between 0.8° and 33.5°, while the estimated fraction of GRB-bright NSBH mergers ranges between ~1–63% with the Fermi/GBM data. These results underscore the potential of multimessenger astronomy, combining gravitational wave and electromagnetic observations. **[**Kapadia, Shasvath J. et al. (including **Misra, K.** & **Jain, Dhruv**). (2024). *Astrophys. Jr. Letters, 976,* L10 (7pp)**]**.

## Automated transient detection with the 4m ILMT

The International Liquid Mirror Telescope (ILMT) is a 4-metre, zenith-pointing telescope located in the Himalayan foothills, designed to perform continuous sky surveys for time-domain astronomy. Developed through an international collaboration between institutions in Belgium, Canada, and India, the ILMT achieved its first light in April 2022 and has been operational since then, observing in SDSS g′, r′, and i′ filters. Several interesting time domain astronomy science cases can be pursued with the ILMT data, such as detecting transients, variable objects, asteroids, gravitational lensed systems, etc. **[Surdej, J.,** Hickson, P., **Misra, K. , Banerjee, D.,** & **Ailawadhi, B.** et al. (including **Dubey, Monalisa, Dukiya, N., Kharayat, M., Kumar, H., Kumar, M., Kumar, T. S., Kumari, P., Prabhavu, S., Pranshu, K., Rawat, H., Reddy, B. K., Pillai, A. S.** & **Singh, K.**). (2025). *Astron. Astrophy., 694,* A80 (11pp)**]**.

To support this, the PyLMT transient detection pipeline **(Figure 31)** was developed, employing image subtraction techniques and convolutional neural networks (CNNs) for real/bogus classification and transient categorisation based on host morphology. The pipeline achieves high classification accuracy (94–98%) and precision (0.91), with a median execution time of 29 minutes per image. It is also capable of identifying known Solar System objects using public databases. During the observing cycle of the telescope from November 2023 to May 2024, the pipeline has detected numerous variable stars, catalogued asteroids, and 12 extragalactic transients, including two new discoveries **(Figure 32)**. This demonstrates ILMT's capability as a powerful, cost-effective tool for automated transient detection and time-domain science. [**Pranshu, Kumar, Misra, Kuntal, Ailawadhi, Bhavya, Dubey, Monalisa** & **Dukiya, Naveen** et al. (2025). *Mon. Not. Roy. Astron. Soc.* , *538,* 133–152].

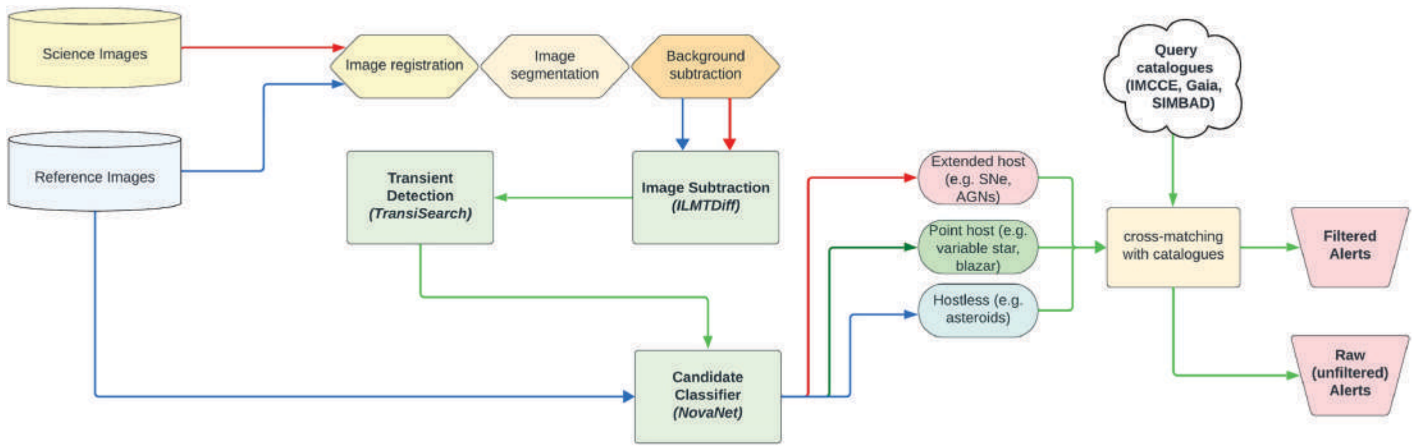



***Figure 31.*** *Schematic diagram of the PyLMT transient detection pipeline. The diagram illustrates the three basic steps for carrying out the image subtraction (ILMTDiff), transient detection (TransiSearch), and candidate classification (NovaNet). An additional catalogue cross-matching step identifies catalogued host galaxies and filters out the catalogued minor planets and bright variable stars.*

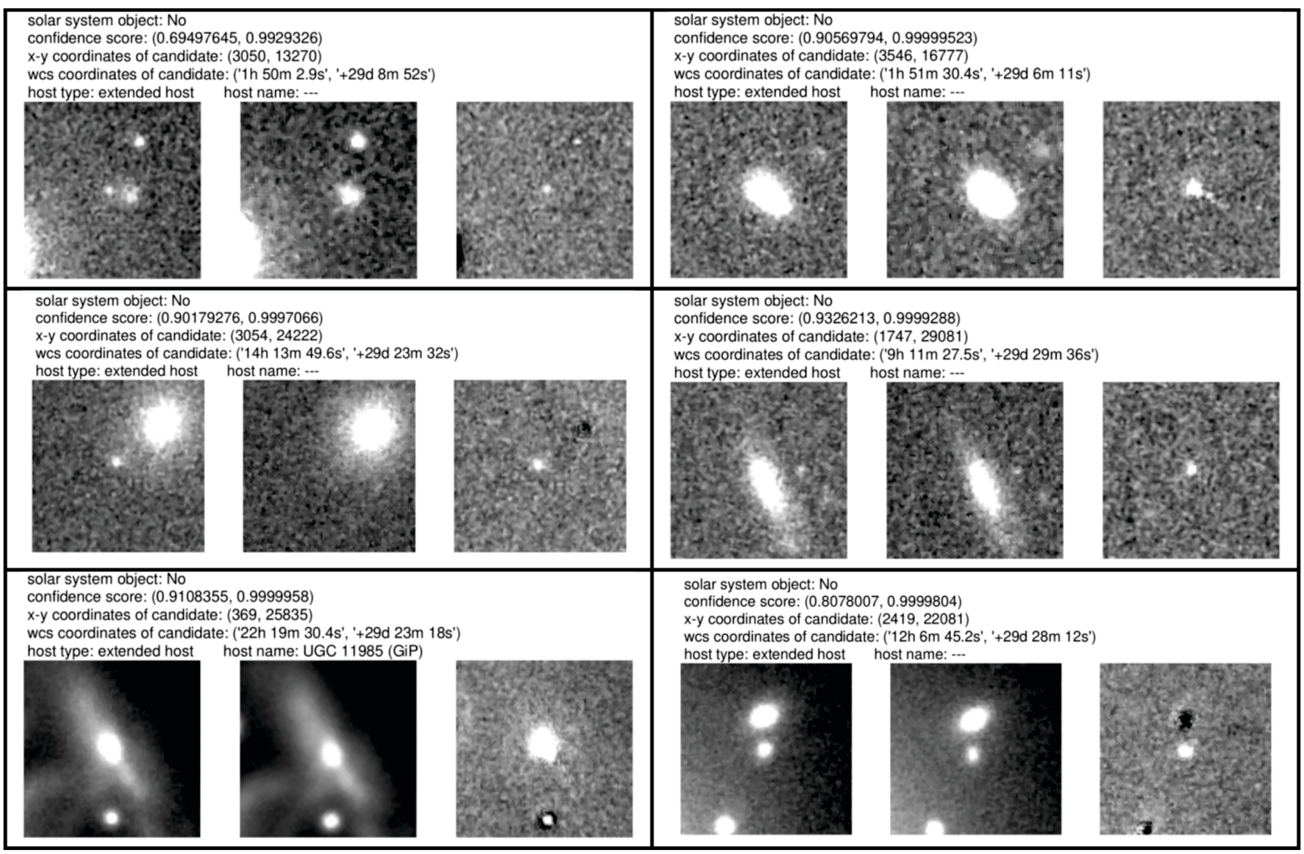



***Figure 32.*** *Left column (top to bottom): PyLMT discovery of the new transients AT 2023yjc and 2024fxn on 2023 November 13 and 2024 April 5, respectively. The bottom panel illustrates the detection of the catalogued type-Ia SN 2023wuk. The images from left to right illustrate ~33 arcsec x 33 arcsec cut-out of the science image with the transient source, an older reference (or template) image and the subtracted (or difference) image resulting from the subtraction between the two. The results are in the adopted PyLMT alert format. Right column (top to bottom): Detection of transients AT 2023xow on 2023 November 11, SN 2024cjb on 2024 February 14 and AT 2024ekk on 2024 March 16.*

## Spectrophotometric reverberation mapping of intermediate-mass black hole NGC 4395

Understanding the origins of massive black hole seeds and their coevolution with their host galaxy requires studying intermediate-mass black holes (IMBHs) and estimating their mass. Accordingly, the mass of an elusive intermediate-mass black hole (IMBH) was successfully measured in the low-luminosity Seyfert 1 galaxy NGC 4395, using data from the 1.3m and 3.6m optical telescopes at Devasthal Observatory, ARIES **(Figure 33)**. Over two nights in March 2022, a spectrophotometric reverberation was performed to map and estimate the size of the galaxy's broad-line region. The analysis revealed strong Hα emission and a time delay of about 125 minutes, which was longer than previously reported. Using the observed velocity dispersion, the estimated the black hole's mass is found to be ~22,000 solar masses with an Eddington ratio of 0.06, thus offering valuable clues about the origins of massive black holes. **[Pandey, Shivangi, Rakshit, Suvendu** et al. (including **Jose, Jincen**). (2024). *Astrophy. Jr., 976*, 116 (13pp)**]**.

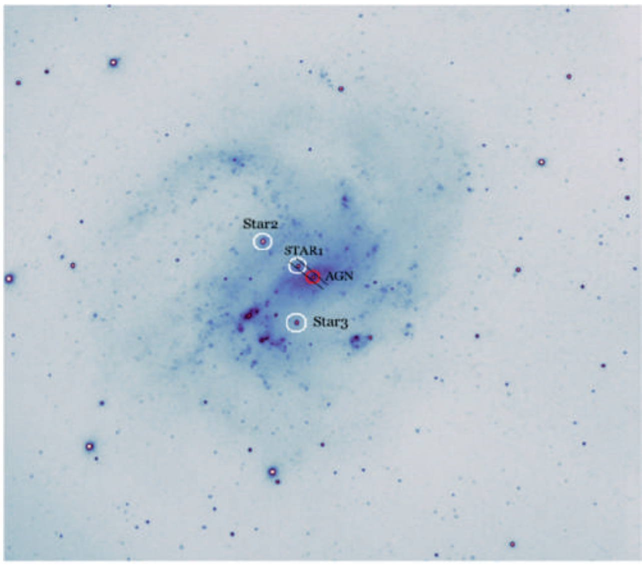



***Figure 33.*** *The combined V-band image of NGC 4395 obtained on 2022 March 10 using the 1.3 m DFOT. Three comparison stars are marked with white circles, while the target AGN is denoted with a red circle. The slit is oriented to cover both the AGN and a comparison star. The field of view is 66' (18'' × 18'18') for the 1.3 m DFOT.*

## Multiwavelength observations of a jet launch in real time from the post-changing-look active galaxy 1ES 1927+654

A two-year multi-wavelength study of the changing-look AGN 1ES 1927+654 was reported, which showed a dramatic radio flare rising ~60 times and the appearance of a spatially resolved jet. A recurring X-ray QPO with increasing frequency was also detected. While soft X-rays brightened ~8×, the UV and hard X-rays remained mostly steady, thus suggesting a stable accretion rate. The observations point to jet formation being triggered by a magnetic field reconfiguration near the black hole, thus activating the Blandford–

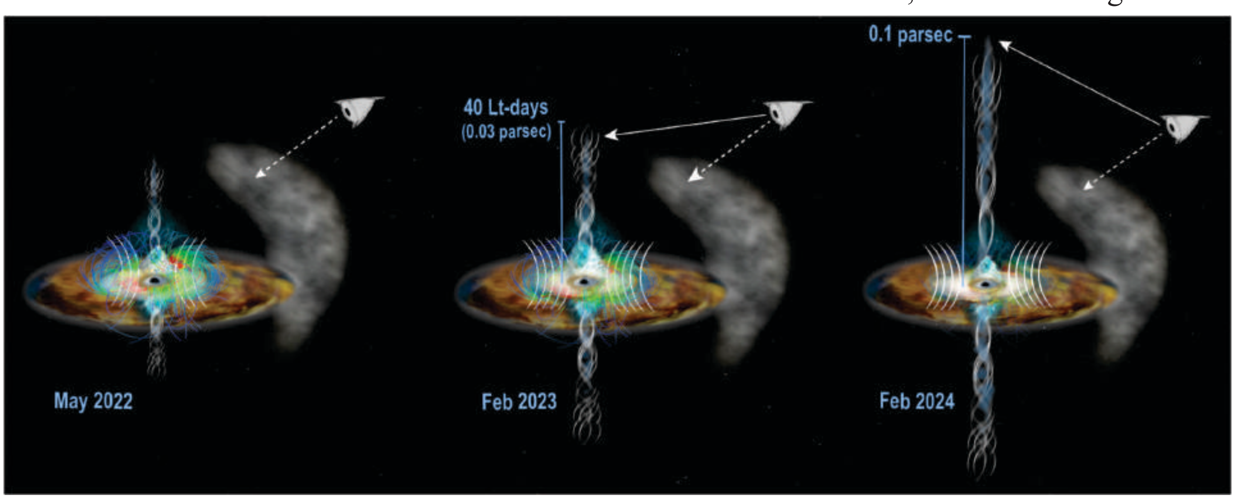



***Figure 34.*** *Cartoon showing the evolution of the accretion disk, corona, and jet in 1ES 1927+654. From left to right: Left (May 2022): Soft X-rays begin to rise, and the jet and a QPO (~0.91 mHz) form. The jet is initially obscured by hot screening gas, possibly BLR clouds (~30–40 light-days), causing free–free absorption. Middle (Feb 2023): The jet emerges beyond the BLR, triggering a strong radio flare. Soft X-rays continue to strengthen, indicating emission from within ~100 rg of the black hole. Right (Feb 2024): The jet extends beyond 0.1 pc and becomes spatially resolved. Soft X-rays are now ~8× brighter than in 2022. Throughout, the UV disk and corona remain largely stable.*

Znajek mechanism **(Figure 34)**. These results offer rare, real-time insights into how magnetic fields shape both the corona and jet in AGN systems. [Laha, Sibasish et al. (including **Rakshit, Suvendu**). (2025). *Astroph. Jr.*, 981, 125 (20pp)].

## Testing particle acceleration in blazar jets with continuous high-cadence optical polarization observations

In this paper, the first continuous, 24+ hour polarization monitoring of blazars was conducted using 16 telescopes across Asia, Europe, and North America. By tracking BL Lacertae and CGRaBS J0211+1051 for over 685 hours, rapid sub-hour changes in polarization and a striking ~180° rotation in CGRaBS J0211+1051 were revealed within two days. These high-cadence observations offer rare insights into the magnetic field dynamics of blazar jets. While simulations of magnetic reconnection and turbulence reproduce many features, they fall short of capturing the full complexity seen thus emphasizing the need for more advanced models to explain jet physics. [Liodakis, I. et al. (including **Jose, Jincen, Pandey, Shivangi, Rakshit, S. & Sharma, Neha**). (2024). *Astron. Astrophy., 689*, A200 (9pp)].

## Spectropolarimetric view of the gamma-ray emitting NLS1 1H0323 + 342

Gamma-ray emitting narrow-line Seyfert 1 galaxies (NLS1s) are rare and intriguing, hosting powerful jets despite having relatively low-mass black holes compared to blazars. But estimating those black hole masses is tricky due to projection effects in total flux spectra. To overcome this, a polarized light was used as a tool to glimpse the true nature of the central engine in 1H 0323+342, a gamma-ray NLS1. Using the SPOL instrument on the MMT, the galaxy's polarization was measured and a degree of 0.122 ± 0.040% with an angle of 142 ± 9° was observed. The Hα line showed a polarization of 0.265 ± 0.280%. Spectral decomposition revealed a broad Hα FWHM of 1015 km/s, and interestingly, the polarized flux showed similar broadening, thus suggesting a thick, vertically extended broad-line region. Modeling with the STOKES radiative transfer code favored a small viewing angle (9–24°) and a low optical depth ratio, offering new insight into how jets might be launched in these compact but powerful systems. [**Jose, Jincen, Rakshit, Suvendu**, et. al. (including **Neha, Sharma & Pandey, Shivangi**). (2024). *Mon. Not. Roy. Astron. Soc., 532,* 3187-3197].

## A comparative analysis of the active galactic nucleus and star formation characteristics of broad and narrow-line Seyfert 1 galaxies

In a new study comparing two types of active galaxies, a narrow-line Seyfert 1 (NLS1) and broad-line Seyfert 1 (BLS1), surprising insights into black hole growth and star formation were revealed. By analyzing 613 galaxies using data from ultraviolet to far-infrared wavelengths, their energy output was modelled with CIGALE and it found that while both galaxy types form stars at similar rates and have comparable stellar masses, their black holes behave differently. NLS1 galaxies host smaller black holes that grow more efficiently, as shown by their higher Eddington ratios. Contrary to earlier claims, the study found no star formation boost in NLS1s. Interestingly, star formation appears to stall in the most massive galaxies, likely due to AGN feedback, yet radio jets seem to play little role in this suppression. These findings challenge conventional wisdom on galaxy evolution and AGN–star formation links. [Kurian, K. S., Stalin, C. S., **Rakshit, S**., et.al. (2024). *Astron. Astrophy, 688:A32,* (15 pp)].

## Revisiting the dust torus size-luminosity relation based on a uniform reverberation-mapping analysis

This study explores the torus size luminosity relation in 400+ Type 1 AGNs using optical and infrared light curves from WISE. After correcting disk contamination, the torus size scales with AGN luminosity showed more shallowly than expected. The torus size increases with IR wavelength, confirming a layered dust structure. A moderate correlation with the Eddington ratio suggests it may impact the torus size–luminosity trend. [Mandal, Amit Kumar et al. (including **Rakshit, Suvendu**). (2024). *Astrophys. Jr., 968*: 59, (28 pp)].

## Multi-wavelength studies of the binary supermassive black hole blazar OJ 287

A huge optical intraday flare on 2021 November 12 at 2 a.m. UT in the blazar OJ 287 was observed **(Figure 35)**. In the binary black hole model, it is associated with an impact of the secondary black hole (BH) on the accretion disk of the primary. A multi-frequency observing campaign was set up to search for such a signature of the impact based on a prediction made 8 yr earlier. The limits on the source size place it most reasonably in the jet of the secondary BH.

An analysis of Suzaku XIS light curves and spectra of the BL Lac object OJ 287 with observations positioned primarily around proposed recurrent optical outbursts. The first two observations were performed in 2007 April 10–13 (epoch 1) and 2007 November 7–9 (epoch 2) that, respectively, correspond to a low and a high optical state and which, within the binary supermassive black hole (SMBH) model for OJ 287, precede and follow the impact flare. The last three observations, made consecutively during 2015 May 3–9 (epoch 3), were during the post-impact state of the 2013 disc impact and are the longest continuous X-ray observation of OJ 287 taken before the optical outburst in 2015 December. In the 2015 observations the X-ray spectrum softens during the flare, showing an obvious soft X-ray excess that was not evident in the 2007 observations.

Using nearly simultaneous radio, near-infrared, optical, and ultraviolet (UV) data collected since 2009, we constructed 106 spectral energy distributions (SEDs) of the blazar OJ 287. These SEDs are well fitted by a log-parabolic model. By classifying the data into "flare" and "quiescent" segments, we find that the median flux at the peak frequency of the SEDs during the flare segments is 0.37 ± 0.22 dex higher compared to the quiescent segments, while no significant differences are observed in the median values of the curvature parameter b or the peak frequency νp. A significant anti-correlation is detected between log νp and b, with a slope of 5.79 in the relation between 1/b and log νp, closer to the prediction from a statistical acceleration model than a stochastic acceleration interpretation, though a notable discrepancy persists. [Valtonen, Mauri J. et al. (including **Gupta, Alok C.** & **Kishore, Shubham**). (2024). *Astrophys. Jr. Lett., 968*: L17, (8pp); Zhou, Dongtao, Zhang, Zhongli, Gupta, Alok C., et. al. (2024). *Mon. Not. Roy. Astron. Soc., 532*, 3285-3298; Zuo, Wenwen & **Gupta, Alok C.** et al. (2025). *Astrophy. Jr., 979*, 210 (12pp)].

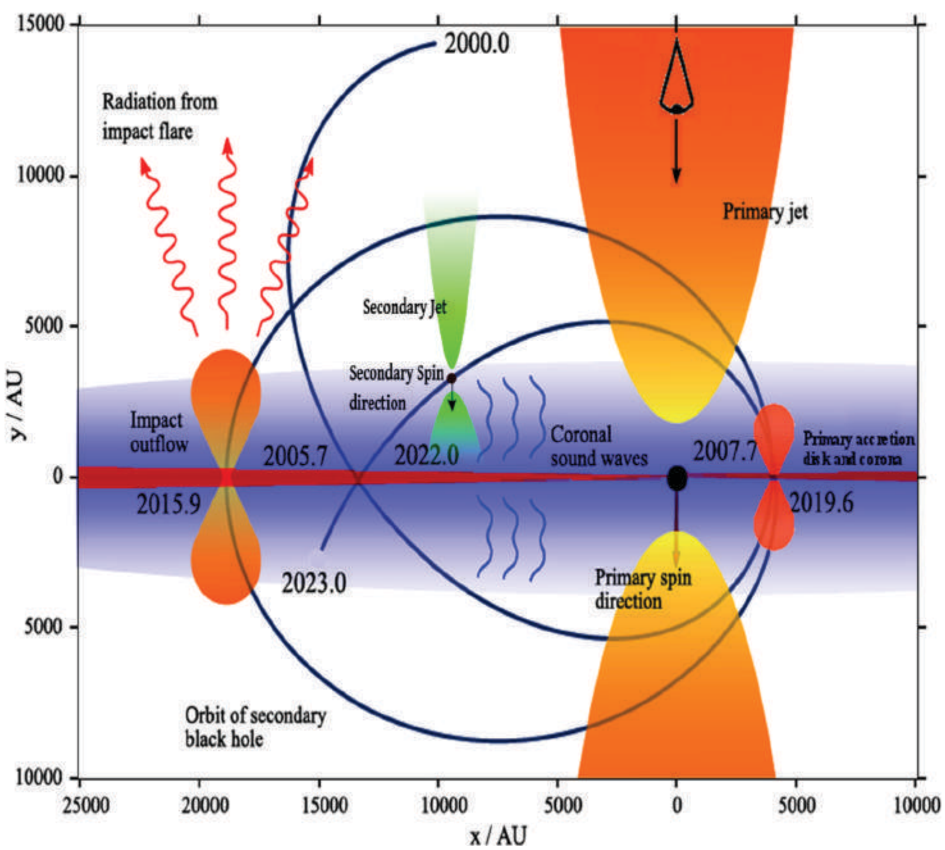



***Figure 35.*** *The binary model of OJ 287. The secondary jet pointing at us is thought to be the source of the 12 November, 2021 flare. The size of the radiating region is comparable to the expected cross section of this jet but far too small for that of the primary jet.*

## Rapid optical flare in the extreme Teraelectronvolt (TeV) blazar 1ES 0229+200 on intraday timescales with the transiting exoplanet survey (TESS) satellite

The optical light curve of TESS observations provides the first evidence of a strong, rapid, short-lived optical flare on the intraday timescale in the TeV blazar 1ES 0229+200. The variability timescale of the flare provides the upper limit for the size of the emission region to be within $(3.3 \pm 0.2 - 8.3 \pm 0.5) \times 10^{15}$ cm. Away from the flare, the slope of the periodogram's power spectrum is fairly typical of many blazars ($\alpha < 2$), but the nominal slopes for the flaring regions are very steep ($\alpha \sim 4.3$), which may indicate that the electron distribution undergoes a sudden change. **[Kishore, S., Gupta, A. C.,** Wiita, P. J. & Tiwari, S. N. (2024). *Astron. Astrophy., 690*, A223 (7pp)**]**.

## Long term multi-band optical variability and multi-frequency radio Quasi Periodic Oscillations (QPOs) in the Blazar 3C 454.3

Due to its peculiar and highly variable nature, the blazar 3C 454.3 has been extensively monitored by the WEBT team. Here, long-term optical flux and color variability results are presented using data acquired in B, V, R, and I bands over a time span of about two decades **(Figure 36)**. The data are binned and segmented to study the source over this long term when more regular sampling was available. The long-term spectral variability reveals a redder-when-brighter trend, which, however, stabilizes at a particular brightness cutoff of ~14.5 mag in the I band, after which it saturates and evolves into a complex state. This trend indicates increasing dominance of jet emission over accretion disk (AD) emission until jet emission completely dominates.

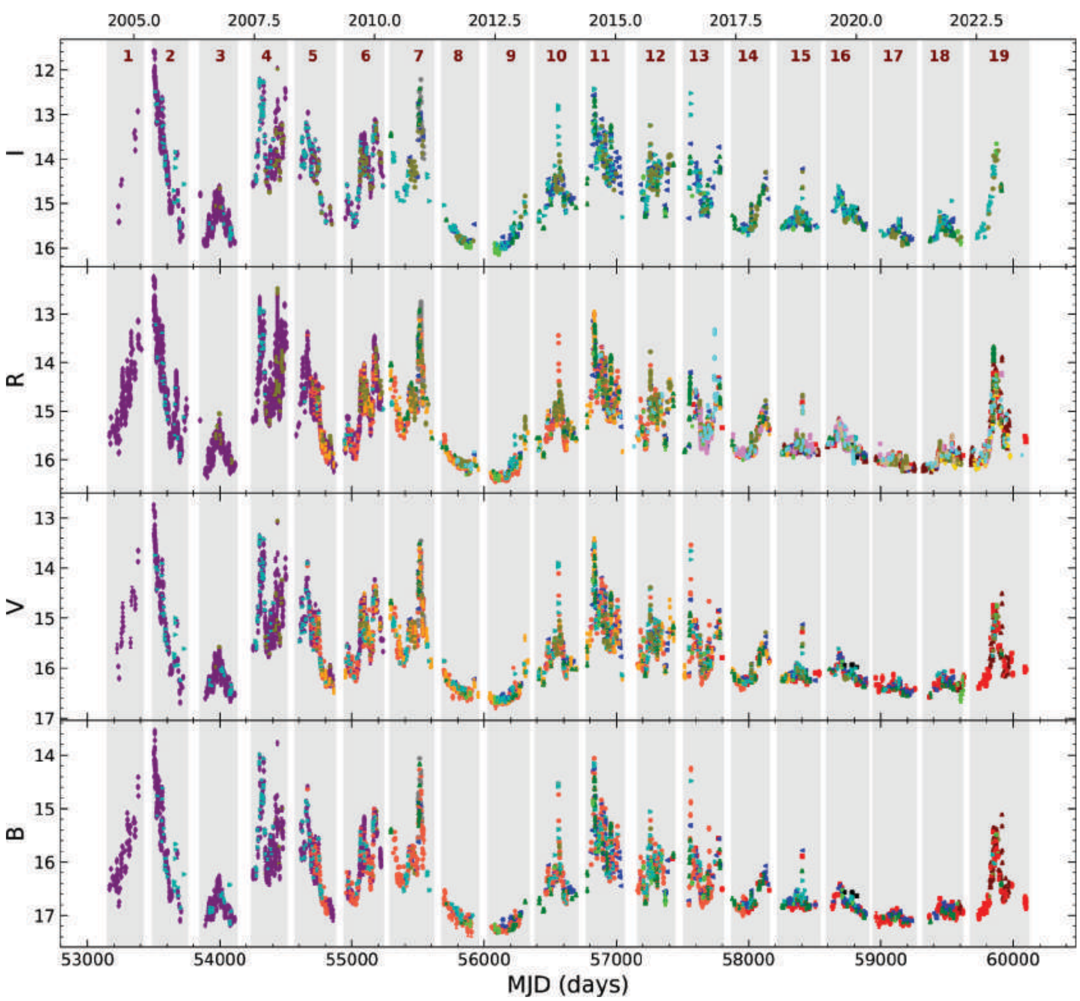



***Figure 36.*** *Extensively monitored optical LCs of the source Blazar 3C 454.3 in BVRI bands.*

Five radio frequencies, 4.8, 8.0, 14.5, 22.0, and 37.0 GHz between 1979 and 2013 as observed at the University of Michigan Radio Astronomical Observatory, Crimean Astrophysical Observatory, and Aalto University Metsähovi Radio Observatory were used to examine quasiperiodic oscillations (QPOs) in the blazar 3C 454.3. Generalized Lomb–Scargle periodogram (LSP) and weighted wavelet transform (WWZ) analyses were used to search for periodicities in these light curves. A confirmed QPO period of ~2000 days to be at least 4σ significant using both methods at all five radio frequencies between 1979 and 2007, after which a strong flare changed the character of the light curve. **[Dogra, Karan & Gupta, Alok C.** et al. (2025). *Astroph. Jr. Suppl. Sr., 276*, 1 (14pp); Tripathi, Ashutosh & **Gupta, A. C.** et al. (2024). *Astroph. Jr., 977*, 166 (13pp)**]**.

### Simultaneous X-ray and optical polarization of the blazar Mrk 421

Near-simultaneous X-ray and optical polarization measurements of the blazar Mrk 421 revealed an energy-dependent polarization trend. IXPE detected a higher X-ray polarization (8.5% ± 0.5%) compared to optical (decreasing from 4.27% in B to 3.13% in R). This suggests a stratified emission region with a shock front, where higher-energy X-ray emitting electrons reside in a more ordered magnetic field closer to the shock. Broadband spectral energy distribution modeling also supported this interpretation. [Bharathan, Athira M. et al. (including **Wani, Kiran, Joshi**, **Santosh** & **Pandey, J. C.**) (2024). *Astrophy. Jr., 975*, 185 (7pp)**]**.

## Numerical and Theoretical Astro-physics

*Relativistic flows around the compact objects are investigated using numerical simulations and semi analytical models. The group also investigates the origin of cosmic rays and multimessenger connections of the astrophysical sources.*

### Numerical simulation of radiatively driven transonic relativistic jets

Relativistic jets from AGN and microquasars have varied terminal speeds, where some of them show ultra-relativistic jets, (Lorentz factors ~ few tens), some show mildly relativistic jets (~ terminal speed 50 % that of the speed of light). While jets are launched from the accretion disc, so it should start with very low speed. Therefore, the acceleration mechanism of astrophysical jets is a mystery.

Numerical simulations of axisymmetric, relativistic, optically thin jets under the influence of the radiation field of an advective accretion disc were performed. It was found that starting from a very low injection velocity at the base, jets can be accelerated to

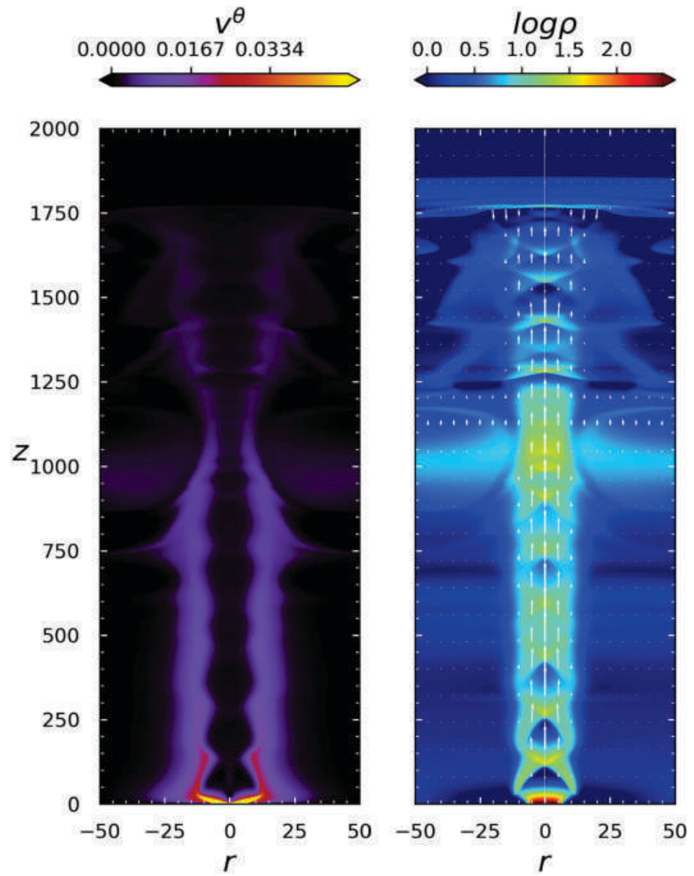



***Figure 37**: Contours of $v^\theta$ and logρ for a rotating jet model plotted at $t = 2400\ t_g$.*

relativistic terminal speeds when traveling through the radiation field. The radiation field from the accretion disc transfers momentum onto the jet material and accelerates the jets to relativistic speeds. A relativistic equation of state for multispecies plasma was used, which self-consistently calculates the adiabatic index for the jet material. All the jet solutions obtained were transonic in nature. In addition to the acceleration of the jet to relativistic speeds (Lorentz factors ~ 30) , the results show that the radiation field also collimates jet by radiation pressure as well as by removing angular momentum of the jet **(Figure 37)**. **[Joshi, Raj Kishor , Chattopadhyay, Indranil** , Tsokaros, Antonios & **Tripathi, Priyesh** . (2024). *Astrophy. Jr., 971:13,* (13 pp)**]**.

## On disk formation around isolated black holes via stream accretion

The processes of formation of accretion disc from stream flows onto a black hole were investigated. Such stream flows can be due to stellar winds directed towards a black hole, or a tidally disrupted star near a black hole. It was found that if the flow is axisymmetric like Bondi Hoyle Lyttleton type, then the accretion disc never forms. However, if the stream is not directed toward the black hole and flows past it, then a fraction of the flow can be attracted by the black hole, and this type of accretion cannot be described by the classical BHL. The second kind is termed as the lateral BHL. The results show that the lateral BHL can form transient accretion disks. To describe the thermodynamics of the flow, a variable adiabatic index equation of state was used which depends on the temperature of the flow as well as the composition of the gas. The electron-proton gas forms an accretion disk, which disappears and forms a shock cone, only to form the disk again at a later time, while for flows with fewer protons, the accretion disk, once lost, does not reappear again **(Figure 38)**. Only when the flow is pair-dominated does it form a persistent accretion disk. It was also found that a shock cone is less luminous than the accretion disk. **[Tripathi, Priyesh Kumar, Chattopadhyay, Indranil & Joshi, Raj Kishor**. (2025). *Astrophy. Jr., 979*: 61 (11pp)**]**.

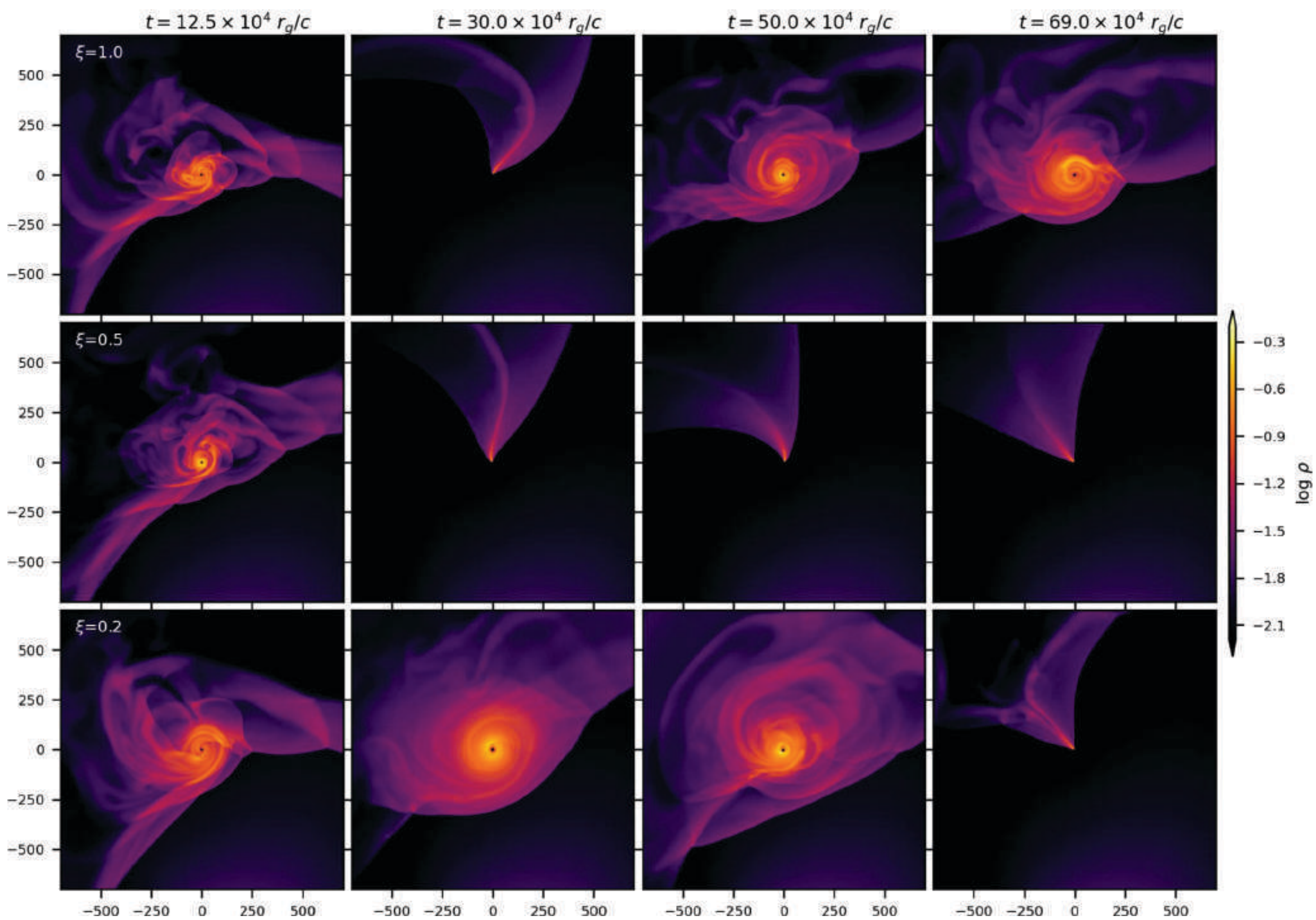



***Figure 38.*** *Snapshots of logarithmic density distribution at different times t = 12.5, 30.0, 50.0, 69.0 × $10^4 r_g$ /c are shown in different columns for models Mp5X1 (ξ = 1.0), Mp5Xp5 (ξ = 0.5), and Mp5Xp2 (ξ = 0.2) in upper, middle, and lower panels, respectively. The length is measured in units of the Schwarzschild radius $r_g$.*

## Spatio-spectral-temporal modelling of two young pulsar wind nebulae

Pulsar wind nebulae (PWNe) are structures powered by pulsars, which are rapidly spinning, highly magnetized neutron stars. As the pulsar spins, it emits a relativistic wind composed of electrons, positrons, and magnetic fields. When this wind interacts with the surrounding medium, usually the supernova remnant or interstellar material, it creates a glowing nebula. Recent observations of a few young PWNe have revealed their morphologies in some detail. Given the availability of spatio-spectral-temporal data, multi-zone (1D) leptonic emission code was used to model the PWNe associated with G29.7−0.3 (Kes 75) **(Figure 39)** and G21.5−0.9 (G21.5), and obtain constraints on diffusive model parameters compared to spectral-only modelling. **[**Kundu, A. & **Joshi, Jagdish C.** et al. (2024). *Mon. Not. Roy. Astron. Soc*, *535*, 2415–2435**]**.

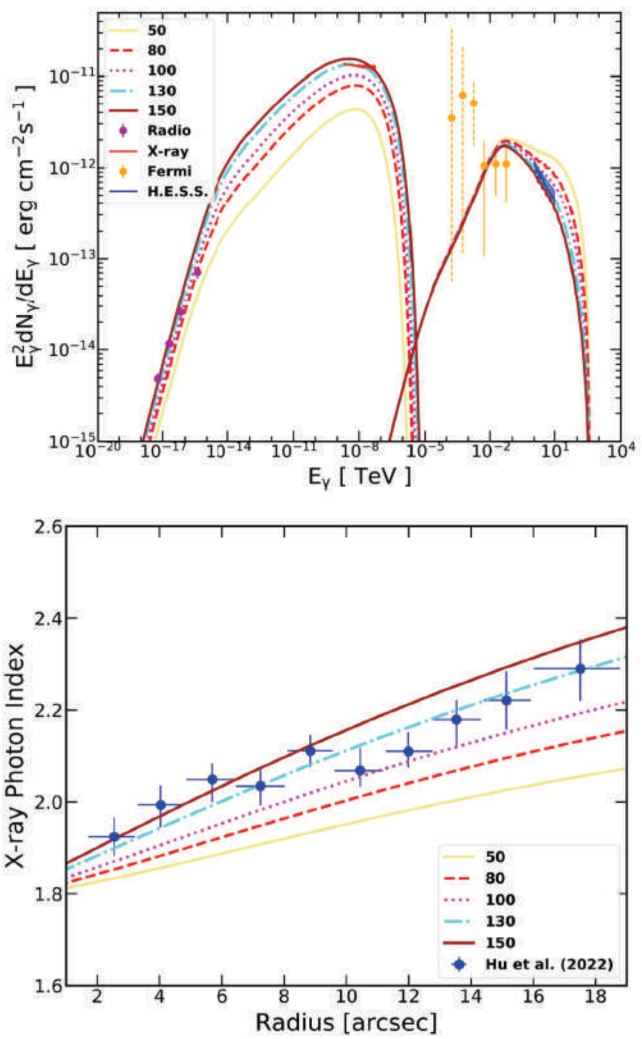



***Figure 39.*** *Top: The predicted SED for Kes 75, showing the effect of varying the present-day magnetic field strength in μG. Bottom: The variation in X-ray photon index with magnetic field over projected radial distance for Kes 75. The magnetic field inside the PWNe at the current age of ~720 years is 150 μG.*

### Hadronuclear interactions in AGN jets as the origin of the diffuse high-energy neutrino background

The source of diffuse high-energy neutrinos, ranging from TeV to PeV energies and observed by the IceCube Observatory, is still unknown. The calculations show that p-p interactions in AGN jets have the potential to contribute significantly towards diffuse neutrino background. It was ensured that the corresponding gamma-ray flux does not overshoot the diffuse gamma-ray background. The study claims that AGN jets pointed towards the observer can explain the PeV neutrino background and jets with a large viewing angle can explain the TeV neutrino background. **[**Xue, Rui, Wang, Ze-Rui, **Joshi, Jagdish C.** & Li, Wei-Jian. (2024). *Astrophy. Jr.*, 971:146, (8 pp)**]**.

## The Sun and the Solar System

*The Sun being our closest star allows us to study the stellar activity and dynamics in great detail. The solar physics group studies different regions of the Sun spanning from the solar interior to the extended outer atmosphere. Specific research areas of interest include the differential rotation of the Sun, observations of magnetohydrodynamic (MHD) waves, solar atmospheric seismology, and CME kinematics.*

### Modelling the propagation of slow magneto-acoustic waves in a multistranded coronal loop

The propagation properties of slow magnetoacoustic waves in a multi-stranded coronal loop was studied by employing numerical simulations and forward modelling techniques using a 3D MHD model. The coronal loop as a bundle of 33 isolated vertical strands was considered, each of 100 km radius, randomly distributed over a circular region of 1 Mm radius. The plasma density and temperature within the strands were selected randomly from predefined ranges. An ideal MHD setup with a low plasma-beta condition was applied. By periodically perturbing the vertical velocity near the base, slow waves were generated in the loop. Synthetic images corresponding to different wavelength channels of the Atmospheric Imaging Assembly (AIA) onboard the Solar Dynamics Observatory (SDO) were generated, and time-distance maps were created to analyse the propagation properties **(Figure 40)**. The results indicate that the appearance/ non-appearance of slow waves in a particular wavelength channel is dependent upon the cross-field thermal distribution of coronal loops. The obtained propagation speed is also sensitive to the available temperature range. Overall, the study demonstrates the potential of slow magnetoacoustic

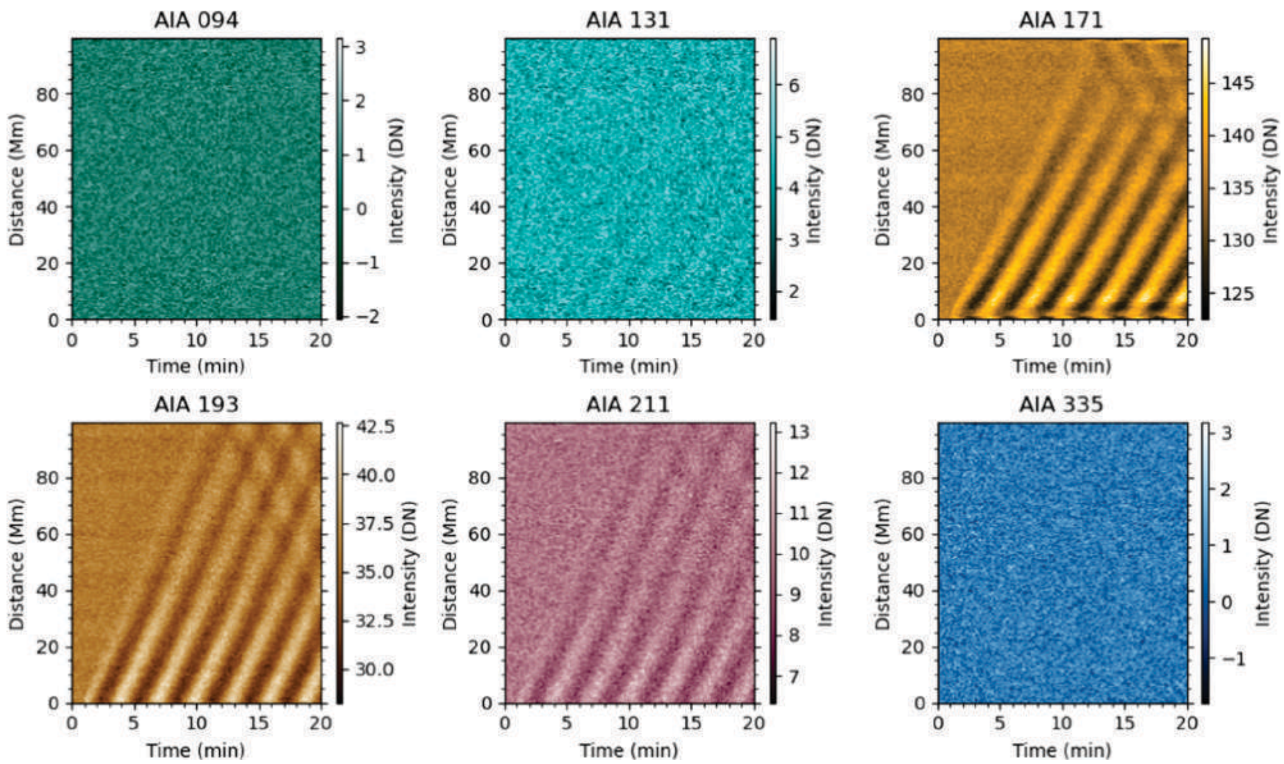



***Figure 40****. Synthetic time-distance maps generated from a simulated multi-stranded coronal loop. These maps highlight the visibility of slow magnetoacoustic waves (slanted alternating ridges in brightness) only in specific wavelength channels, depending on the cross-field thermal distribution of the simulated loop.*

waves in probing the thermal structure of coronal loops. [**Krishna Prasad, S.** & Van Doorsselaere, T. (2024). *Astrophys. Jr., 970*: 58 (8pp)].

## Formation height of low-corona and chromo-spheric channels of the Atmospheric Imaging Assembly (AIA) onboard the Solar Dynamics Observatory (SDO)

The formation heights of various low-corona were estimated and chromospheric wavelength channels were employed by AIA onboard SDO. The multi-wavelength data from SDO/AIA is widely used and have been continuously available since its launch in February 2010; thus, the formation height of its different imaging channels is a vital parameter to enable a comprehensive understanding of various dynamic phenomena in the solar atmosphere. Employing the phase lag analysis on propagating slow magnetoacoustic waves observed within sunspot umbrae, the formation height and its variation across 20 different active regions were calculated **(Figure 41)**. One of the findings of the study is that the AIA 1600 Å channel appears to form below the 1700 Å channel in 17 out of the 20 cases studied. In contrast, the observations in the past mostly considered the formation of these two channels to be the other way around. This discrepancy is mainly due to a recent inference that the 1600 Å channel has a dominant contribution from the continuum during quiet periods. [Sanjay. Y. et al. (including **Prasad, Krishna S.** & **Banerjee, D.**). ( 2024 ). *Astrophy. Jr., 975*, 236 (11pp)].

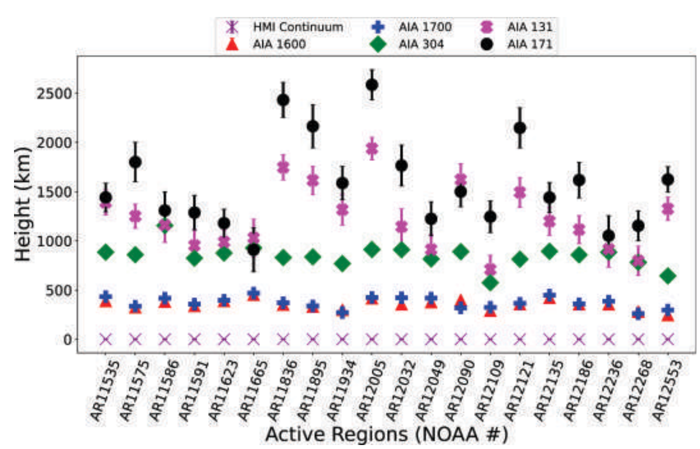



***Figure*** *41. An illustration of the formation heights of different wavelength channels employed by the Atmospheric Imaging Assembly (AIA) onboard the Solar Dynamics Observatory (SDO). The variation in height across 20 different active regions is presented.*

## Exploring the dynamic rotational profile of the hotter solar atmosphere: a multiwavelength approach using SDO/AIA

The study aims to characterize how the Sun's rotation varies across different atmospheric layers from chromosphere to corona by analyzing data from multiple temperature-sensitive wavelength channels observed by SDO/AIA. The study reveals that the Sun's hotter atmosphere rotates more rapidly and with a more uniform latitudinal gradient compared to the photosphere. These findings lend support to a deeper, coherent rotational behaviour extending from the solar interior into higher atmospheric layers, possibly modulated by the solar magnetic cycle. **[Routh, Srinjana** et al. (including **Mishra, Dibya Kirti, Pant, Vaibhav** & **Banerjee, D.**). (2024). *Astrophy. Jr., 975,* 158 (13pp)**]**.

## Transition region brightening in a Moss Region and their relation with lower atmospheric dynamics

The paper shows that the majority of transition region brightening in moss areas are linked to chromospheric spicules, highlighting their importance in solar atmospheric heating while also signalling that other, less-obvious drivers may be at work for the remaining events. **[**Ram, Bhinva et al. (including **Pant, Vaibhav**). (2024). *Astrophy. Jr.*, 977, 25 (10pp)**]**.

## Decayless oscillations in different spatio-temporal scales in the solar atmosphere

A decayless kink oscillations in solar coronal loops was investigated and observed persistent transverse wave motions that maintain amplitude and also explored factors that affect their properties. The study was focused on shorter coronal loop systems and examined how local plasma conditions or dynamic phenomena (like coronal rain) influence oscillation behaviour **(Figure 42)**. It was found that the relationship between loop length and oscillation period was weak, thus implying that the wave behavior in short loops is governed by more complex factors than simple standing kink-mode scaling. In addition, the study demonstrates that increased plasma density from rain slows kink speeds, increases the oscillation period (~1.3× longer) and roughly doubles the amplitude. Unaccounted rain effects could affect derived plasma parameters, which is why dynamic phenomena should be factored into diagnostics. Decayless kink oscillations are a robust and widespread feature of coronal loops, but their properties can deviate significantly from classical models depending on loop size, driving mechanism, and transient events like coronal rain. Both studies emphasise the contextual plasma conditions wherein magnetic topology, atmospheric density changes, and excitation sources must be considered when using these oscillations to probe coronal physics. **[Shrivastav, Arpit Kumar** & **Pant, Vaibhav** (including **Banerjee, D.**). (2025). *Astroph. Jr., 979,* 6 (14pp); **Shrivastav, Arpit Kumar, Pant, Vaibhav** & Antolin, Patrick. (2024). *Astrophy., 689*, A295 (12pp)**]**.

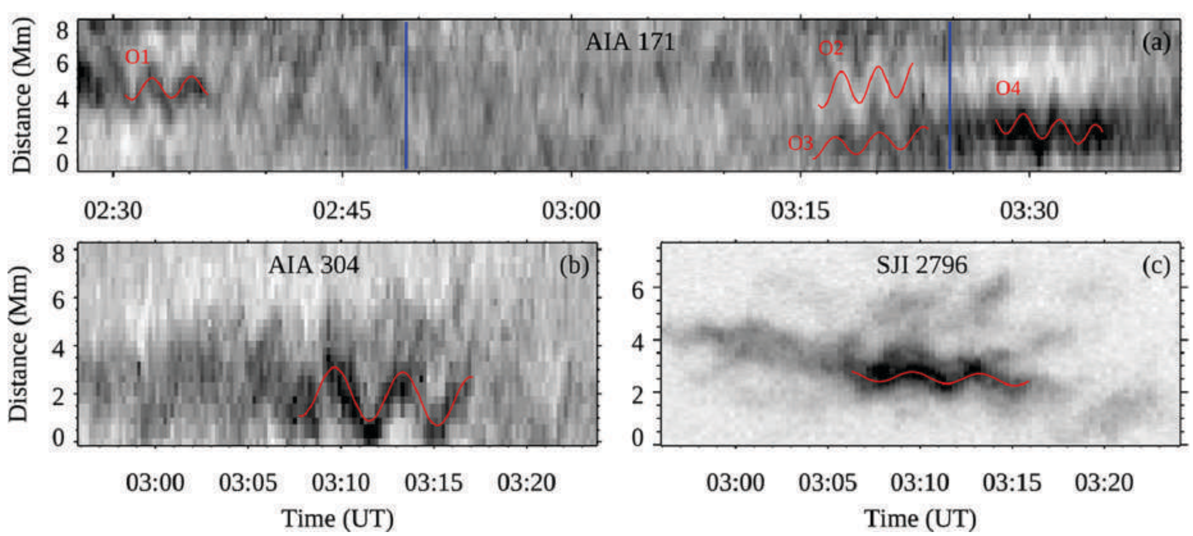



***Figure 42.*** *Tracking of the rain blobs along larger loop. Panels a–c depict the location of the curved slit traced along the rain blobs in AIA 304, SJI 2796, and along the loop in AIA 171.*

# Research Highlights

## Atmospheric Sciences

206.5 MHz ASTRAD

Mie Lidar

Gas Chromatograph

Balloon Flight

*The research activities in Atmospheric Sciences division are oriented to understand the complex physical, chemical and dynamical processes governing the Earth's lower atmosphere. Extensive observations are made using state-of-the-art instruments for trace gases, aerosols, meteorology and dynamics.*

### Trace Gases

#### Influence of Indo-Gangetic Plain emissions on light NMHCs at a high-altitude Himalayan site

Non-methane hydrocarbon (NMHC) studies are scarce in South Asia, particularly at high-altitude sites. This study reported in-situ measurements of light NMHCs (C2–C5) at Nainital (2017–2020) and air samples from Haldwani, a nearby Indo-Gangetic Plain (IGP) site. Diurnal patterns at Nainital **(Figure 43)** indicated relatively pristine conditions, though springtime trajectory analysis (CWT) showed periodic anthropogenic influence from the IGP. Source attribution showed that biomass burning dominates in the mountains, while liquefied petroleum gas, vehicles, and domestic combustion prevailed at Haldwani. Chemical reactivity indicators, including OH reactivity, ozone formation potential (OFP), and secondary organic aerosol potential (SOAFP), are significantly higher at the IGP. Ethane is dominant at Nainital, whereas propane prevails in the plains. These findings highlight the need for detailed NMHC emission inventories in the Himalayan region. **[Rajwar, Mahendar Chand, Naja, Manish & Srivastava, Priyanka** et al. (2024). *Atmos. Pollu. Res., 15*: 102078 (15 pp)**]**.

#### Drivers and impacts of ozone variability in the Himalayan foothills

Ozone levels observed in Dehradun, an urban center between the Himalayas and IGP, showed consistently high daytime values, especially in spring, highest above 110 ppbv. These levels often exceeded national standard limits, except during the monsoon season. The spring peak **(Figure 44)** was linked to biomass burning, which boosted ozone by up to 50%. A chemical model revealed most ozone formed through $HO_2$ reacting with NO and lost through reactions with $HO_2$. High ozone levels were estimated to reduce wheat and rice yields significantly and posed serious health risks, with some pollutants surpassing international safety limits. The region's ozone production was found to be highly sensitive to nitrogen oxides, with aromatic compounds playing a major role. **[Rajwar, Mahendra Chand, Naja, Manish,** Kant, Y., **Rawat, Prajjwal, Tomar,**

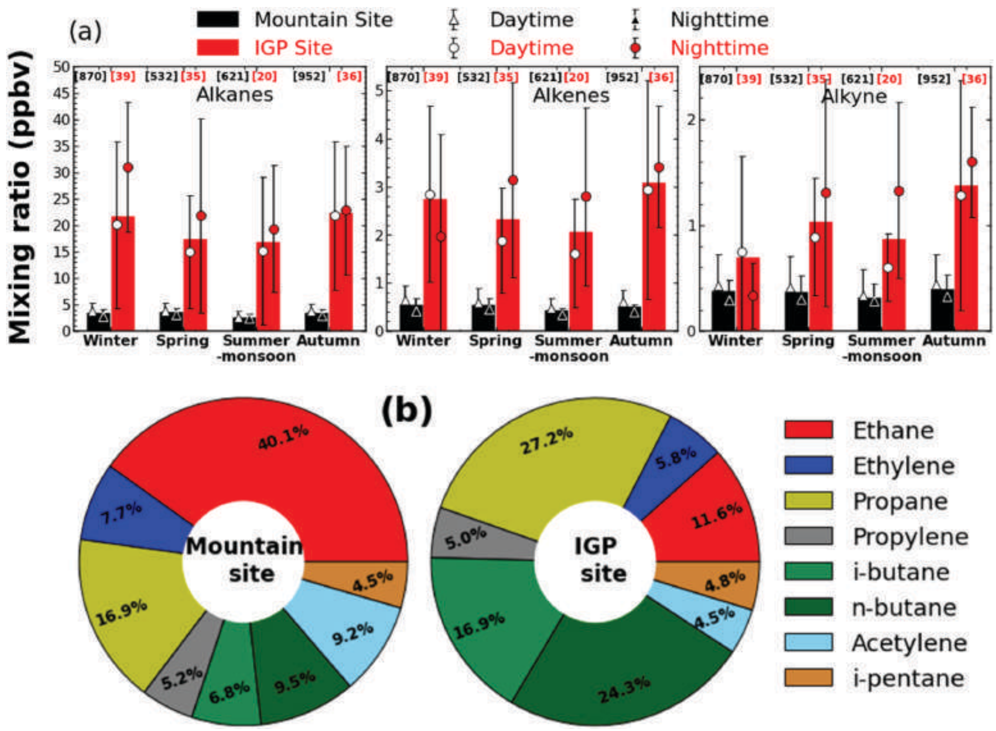



***Figure 43.*** *(a) Seasonal average mixing ratios of alkanes (ethane, propane, i-butane, n-butane, i-pentane), alkenes (ethylene, propylene), and alkyne (acetylene) with 1σ at the mountain and IGP sites. Daytime (0700–1900 h) and night-time (1900–0700 h) averages are also shown. (b) Annual percentage contributions of the eight light NMHCs at both sites.*

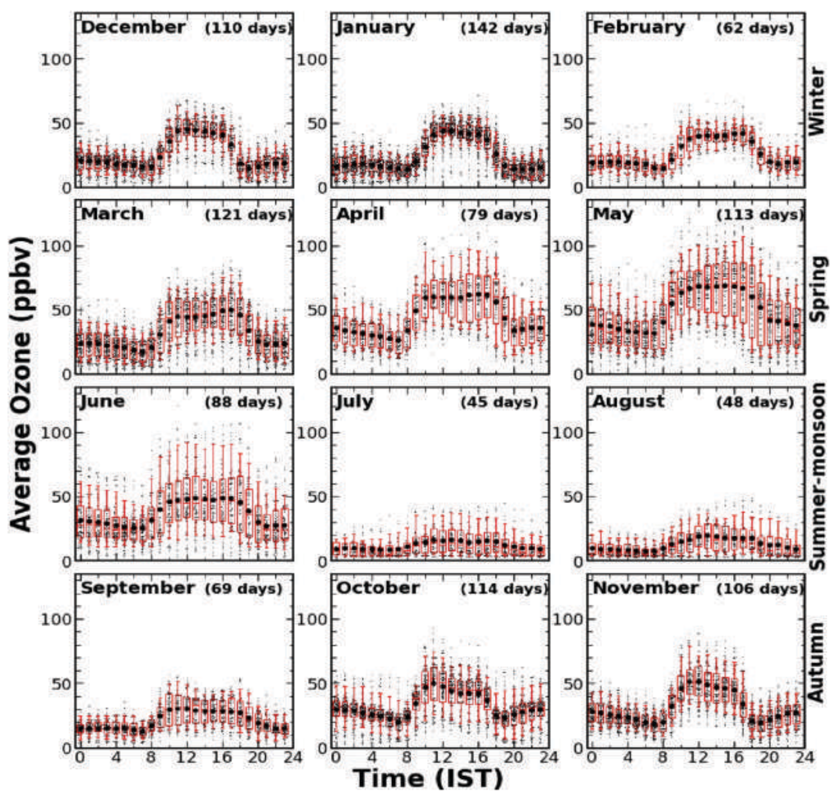



***Figure 44.*** *Diurnal variations in hourly average ozone. In box plots, the upper and lower edges of the boxes represent the third quartile (75th percentile) and first quartile (25th percentile), respectively. The whiskers below and above are the minimum (5th percentiles) and maximum (95th percentiles). The black circles and horizontal lines represent the monthly mean and median of the observed data, respectively. Grey dots show the individual hourly averaged data. The total number of observation days in each month is written in parenthesis.*

**Vikrant,** Tiwari, R. K. & Lal, S. (2024). *Air Quali. Atmos. Health, 17*, 2263-2276**]**.

## Characterizing trace gases over the Himalayan foothills: multi-year MAX-DOAS and satellite perspectives

Regional air pollution is a major concern in India, especially over densely populated regions such as the IGP and the adjacent Himalayas, where pollutants can accumulate and transport extensively. To address sparse in-situ data, this study carried out $NO_2$, $SO_2$, HCHO, and CHOCHO observations **(Figure 45)** from Pantnagar (Himalayan foothills) using MAX-DOAS, along with TROPOMI and GOME-2 satellite data for 2017–2020. The results show urban-type diurnal cycles of $NO_2$ and HCHO, a noon peak in CHOCHO, and biases of up to 48% in satellite $NO_2$ retrievals. Sensitivity analyses indicate biogenic VOC sources and a predominantly NOx-limited ozone regime, highlighting the value of integrated ground and space-based observations in this complex environment. [**Rawat, Prajjwal, Naja, Manish, Rajwar, Mahendar C.** et al. (including **Kumar, Mukesh**). (2024). *Atmos. Environ., 336,* 120746 (14pp)].

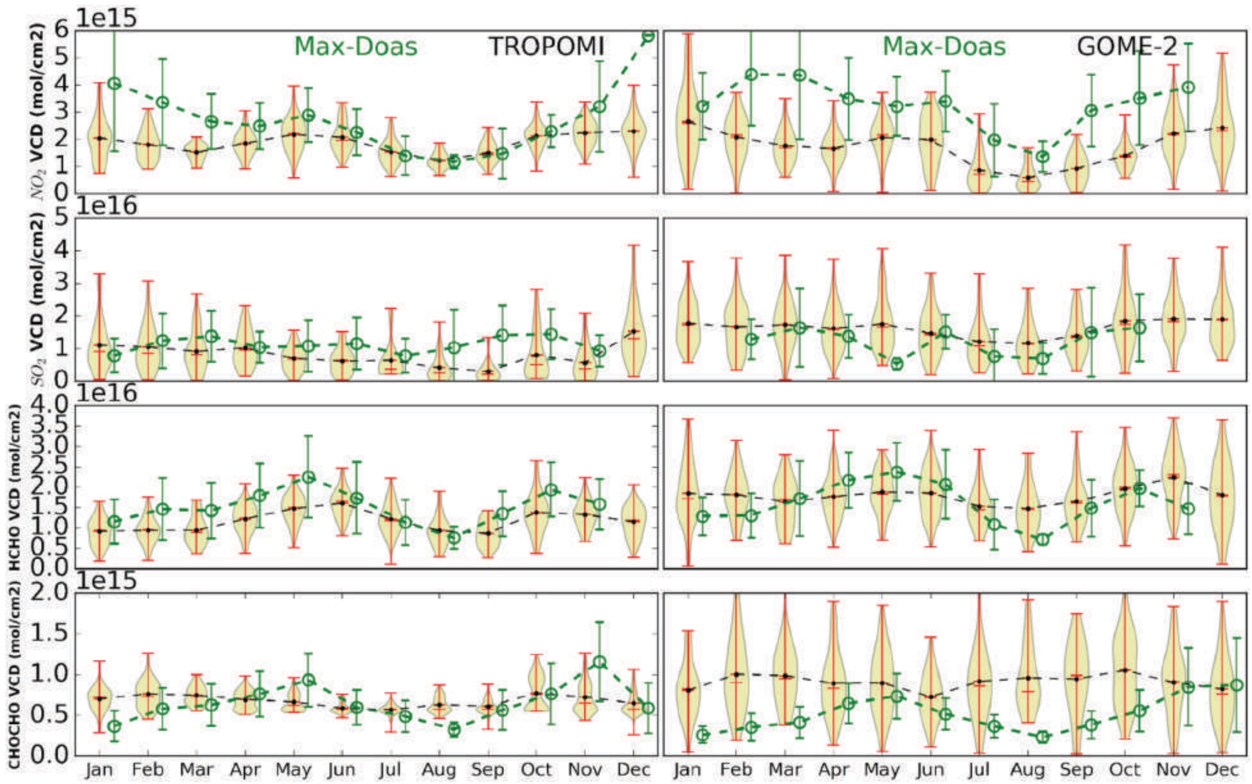



***Figure 45.*** *Monthly variations of $NO_2$, $SO_2$, HCHO, and CHOCHO columns retrieved from MAX-DOAS, TROPOMI, and GOME-2 (in molecules/cm²). MAX-DOAS values are averaged for morning and satellite noontime overpasses. TROPOMI and GOME-2 data are shown as violin plots to illustrate their distributions.*

## Health risks and secondary pollution potential of aromatic hydrocarbons

The Himalayas are vulnerable to pollution transport from surrounding regions, yet information on aromatic hydrocarbons in the central range remains scarce. This study presents the first multi-year BTEX (C6–C8 aromatics) measurements at a mountain site (Nainital, 2017–2022) together with a nearby foothill site in the IGP (Haldwani) **(Figure 46)**. BTEX levels peaked during the day at the mountain site (~6 ppbv) but at night in the IGP (~19 ppbv). Seasonal maxima also differed, with spring/autumn peaks in the mountains and winter peaks in the IGP, driven by transport and local emissions. Xylene dominated (60–65%) at both sites, while OH reactivity, ozone and secondary aerosol formation potentials were 4–6 times higher in the IGP. Benzene posed the greatest health risk, with lifetime cancer risks exceeding safe thresholds. **[Rajwar, Mahendar Chand, Naja, Manish, Rawat, Prajjwal,** Venkataramani, S., Tiwari. R. K. **(2024).** ***Enviro. Sci. Pollu. Res., 32 (3):*** **1525–1540]**.

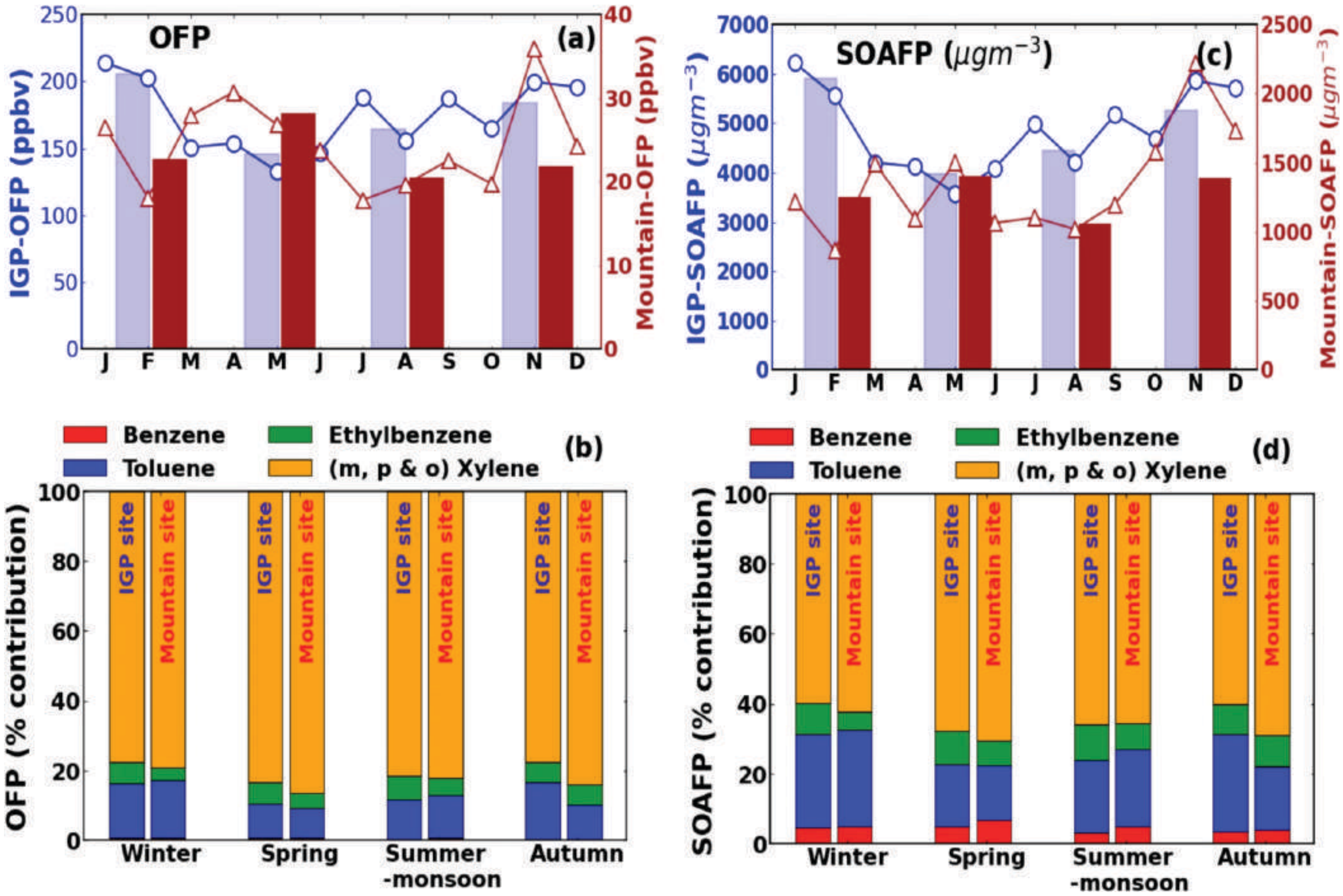



***Figure 46.*** *(a) Monthly ozone formation potential (OFP) from BTEX (2017–2022) at the mountain site (red) and IGP foothill site (blue). (b) Seasonal % contributions of individual BTEX to OFP. (c) Monthly secondary organic aerosol formation potential (SOAFP) from BTEX at both sites. (d) Seasonal % contributions of individual BTEX to SOAFP.*

# Aerosols and Air Quality

## Assessing environmental sustainability: solar, emissions, and material-based studies

Surface solar radiation (SSR) is essential for a sustainable future but is influenced by clouds, aerosols, and atmospheric variability. Analysis over India (1993–2022) shows aerosols reduce SSR by ~13.33%, while high, mid, and low clouds attenuate it by ~30.80%, ~40.10%, and ~44.30%, respectively, with high and mid cloud impacts rising annually **(Figure 47)**. Freight transport is a major contributor to greenhouse gas emissions, and EU carbon taxes and the Zero Carbon Freight Index (ZCFI) assess pricing impacts on emissions. GARCH and FBM modelling (January 2020–August 2022) confirmed the role of carbon pricing in Asia-Pacific emissions. Additionally, oak wood charcoal activated at 300–500 °C produced ACs achieving 83–100% Methylene Blue removal, following pseudo-first-order kinetics, with physical adsorption confirmed by isotherm models and characterization are shown in **Figure 48**, highlighting their effectiveness and recyclability. [Jadhav, Ashwin Vijay et al. (including **Dumka, Umesh Chandra**) (2024). *Climate,* 12: 48 (17pp); Jadhav, Ashwin Vijay, Bhawar, Rohini L., **Dumka, Umesh Chandra** et al. (2024). *Energy Sustain. Develop., 80*: 101444 (11pp), Kimothi, S., Bhatt, V., Kumar, S., Gupta, A., & **Dumka, Umesh Chandra** (2024). *Sustainable Futures, 7,* 100164 (10pp), Twinkle Budhirajaa, Twinkle et al. (including **Dumka, Umesh Chandra**). (2024). *Fullerenes, Nanotubes and Carbon Nanostructures, 33 (5)*, 441–455].

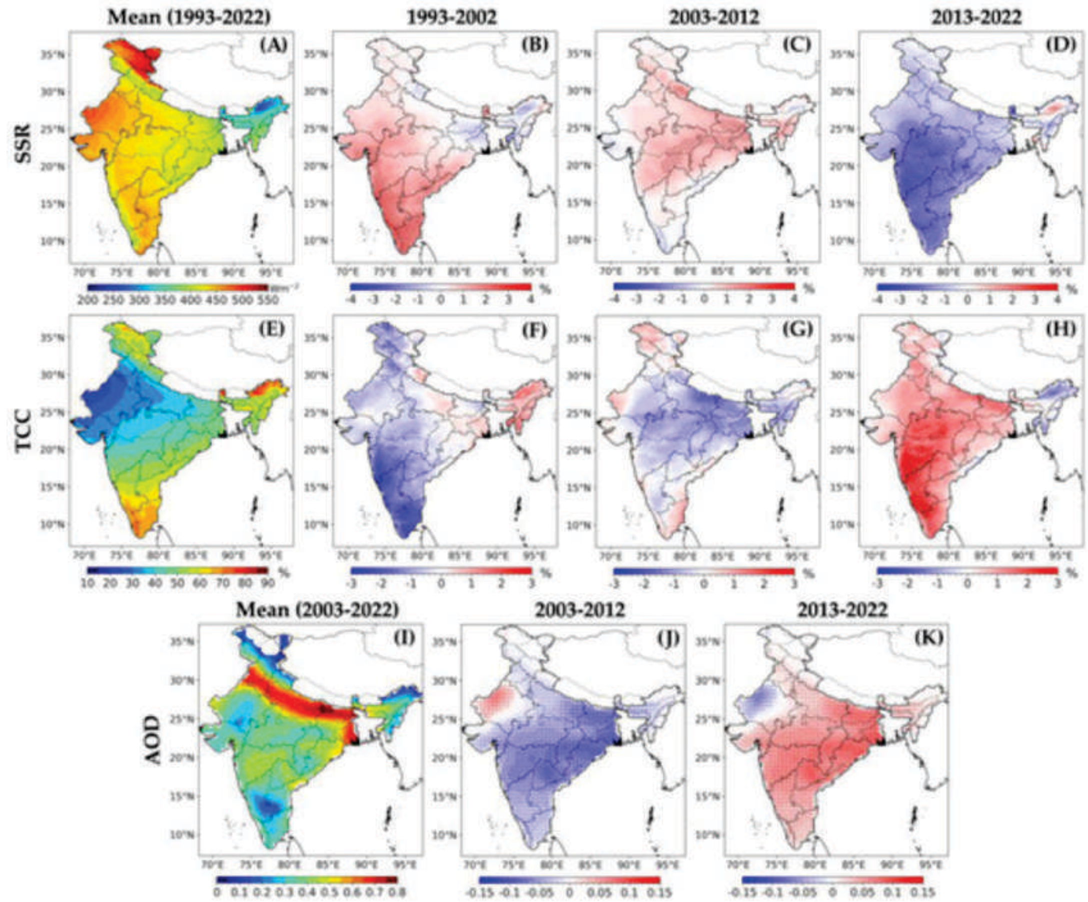



***Figure 47.*** *Spatial distribution of the 30-year means of (A) SSR (Wm*$^{-2}$*) and (E) TCC (%), and 20-year mean of (I) AOD (unitless), with Decadal anomalies of (B–D) SSR (%), (F–H) TCC (%), and (J, K) AOD. Stippling indicates the regions with 95% significance based on Student's t-test.*

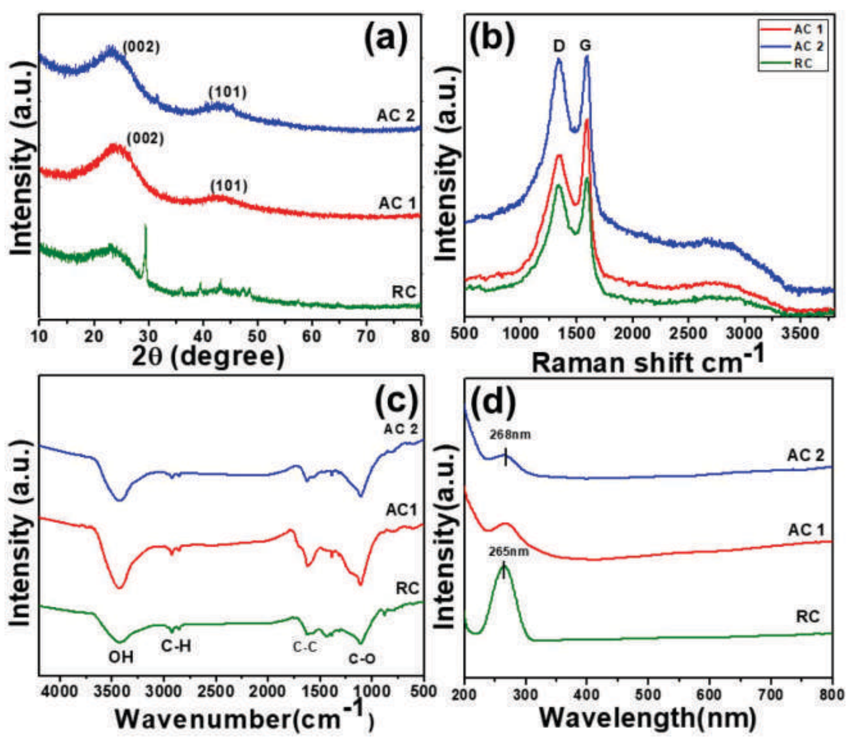



***Figure 48.*** *(a) XRD pattern of RC, AC1, and AC2, (b) Raman Spectra of RC, AC1, and AC2; (c) FTIR of RC, AC1, AC2 (d) UV–vis spectra of RC, AC1, AC2.*

## Spatiotemporal patterns of particulate matter in the Himalayas and adjacent plains

This study presents a multi-site assessment of particulate and gaseous pollutants across the IGP and Himalayan foothills to understand spatiotemporal variations and source influences. In the Central Himalayas, winter biomass burning in northern India elevated $PM_{2.5}$ and absorbing aerosols, significantly affect radiation balance and transport. During the COVID-19 lockdown, $PM_{2.5}$ reductions varied across Delhi/NCR (~62%) and Nainital (~8%), with phase-wise changes, secondary aerosol enhancement, and Stratosphere–Troposphere Exchange (STE) events contributing to elevated ozone levels **(Figure 49)**. Long-term analysis in Delhi (2015–2022) showed a gradual decline in $PM_{10}$, especially during monsoon and post-monsoon, summarized in a yearly Whisker-Box plot illustrating trends, outliers, and guideline comparisons **(Figure 50)**. In Uttarakhand, the lockdown led to sharp declines in PM, $SO_2$, and $NO_2$, confirming human activity impacts. These findings underscore the complex interplay of topography, seasonal dynamics, and anthropogenic emissions in the plains-to-Himalaya transition zone. **[Rawat, Vikas** & **Singh, Narendra** et al. (2025). *Atmos. Environ., 343,* 121015 (17pp); Chetna, Dhaka et al. (including **Singh, Narendra**). (2024). *Environ Monit Assess, 196*: 500 (18pp); Goswami, M. et al. (including **Singh, Narendra**). *Mausam, 75 (3)*, 703-714; Sharma, Kiran et al. (including **Singh, Narendra**). (2024). Book Chapter: *Climate Crisis and Sustainable Solutions*.227-232pp.**]**.

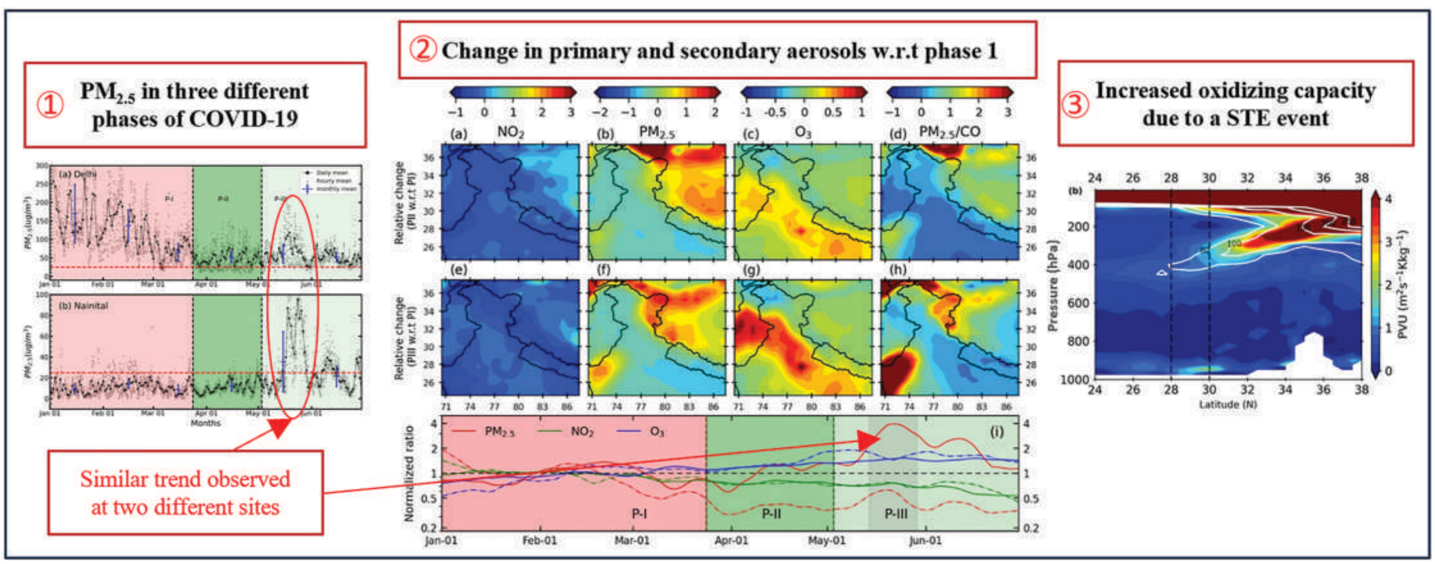



***Figure 49***. *Variations in aerosol characteristics during the 2020 COVID-19 lockdown: (a) Phase-wise $PM_{2.5}$ changes in Delhi/NCR and Nainital; (b) enhanced secondary aerosols ($SO_4^{2-}$, $HNO_3$) during Phase III partial unlock; (c) Stratosphere–Troposphere Exchange (STE) events contributing to elevated ozone and increased atmospheric oxidizing capacity.*

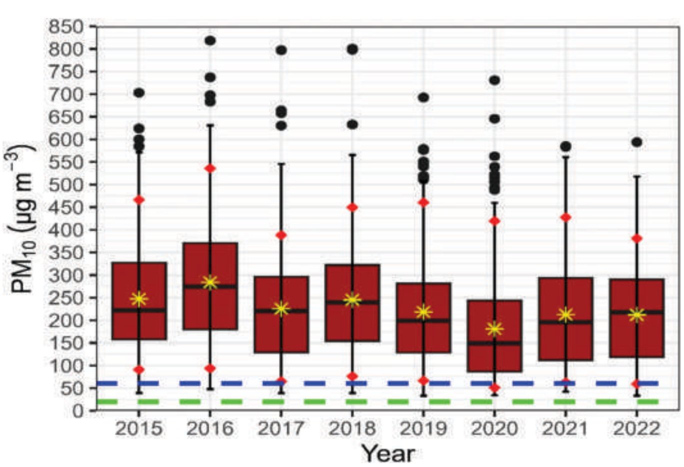



***Figure 50.*** *Whisker-Box plot showing yearly $PM_{10}$ levels from 2015 to 2022. The yellow star indicates the average. The box lines represent the 25th (lower), 50th (median), and 75th (upper) percentiles. Red dots show the 5th and 95th percentiles, black circles denote outliers, and dashed green and blue lines mark the WHO and Indian National Ambient Air Quality Standards (INAAQS).*

# Dynamics and Meteorology

## Mountain meteorological processes and lower atmospheric dynamics

Contrasting dynamical and microphysical characteristics of two precipitation events over the Central Himalayas were investigated using ARIES Stratosphere-Troposphere Radar (ASTRAD) **(Figure 51 (a))** and high-resolution WRF simulations **(Figure 51 (b))**. The first event (Case-I), linked to the Indian summer monsoon on 4 August, 2020, exhibited deep convection (up to 12 km) with liquid-phase precipitation driven by strong updrafts and high CAPE. The second event (Case-II), associated with a western disturbance on 5 February, 2021, was shallower (~6–7 km) and produced both liquid and solid precipitation. Radar Doppler moments revealed distinct vertical structures, with Case-I showing higher spectral width and Case-II sharper reflectivity gradients. WRF simulations confirmed the role of moisture flux, terrain-induced lifting, and phase-specific microphysics. Case-I involved graupel and rain from snow accretion, while Case-II was dominated by cold-phase ice processes. This study underscores the value of combining radar observations with numerical modelling to better understand precipitation dynamics in the complex Himalayan terrain. **[Rajput, Akanksha, Singh, Narendra, Singh, Jaydeep, Kumar, Ashish**, & Rastogi, Shantanu. (2024). *Earth Space Sci., 11*: e2023EA003213, (21 pp)**]**.

## Western disturbance dynamics

This study examined the influence of Western Disturbances (WDs) on wind patterns and precipitation over the central Himalayas using the ASTRAD observations during March, 2024. WD events were associated with predominantly southwesterly and westerly winds. HYSPLIT back-trajectory analysis indicated that moisture-laden air masses originated from the Atlantic Ocean. The core region of the subtropical westerly jet (SWJ) was identified, showing height shifts corresponding to maximum wind speeds peaking at 64 m/s **(Figure 52 (a))**. Vertical wind profiles revealed significant atmospheric instability and winter convection, with updrafts up to 0.26 m/s and downdrafts up to 0.5 m/s **(Figure 52(b))** across

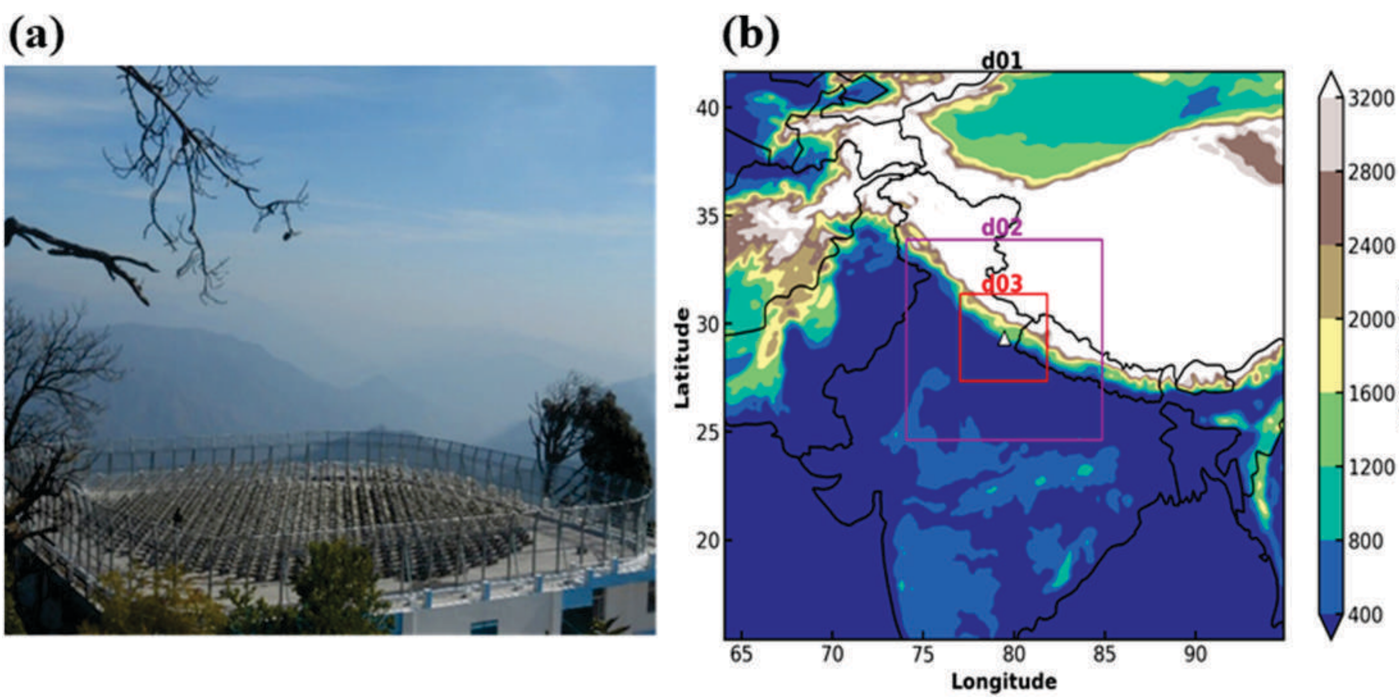



***Figure 51.*** *(a) Site view of the ASTRAD and (b) WRF model simulated domains (d01; black, d02; magenta, and d03; red) along with the topographic height. The white triangle represents the observational site.*

multiple height ranges (4.5–21 km). Peak rainfall coincided with enhanced wind speeds, highlighting the dynamic lower atmospheric conditions. The findings enhance understanding of WD characteristics and their effects on precipitation and weather forecasting in the Himalayan region. **[Bhattacharjee, S., Naja, Manish**, Rawat, K. S., & Tripathi, V. K. (2024). *Environment and Ecology,* 42(4), 1615–1622**].**

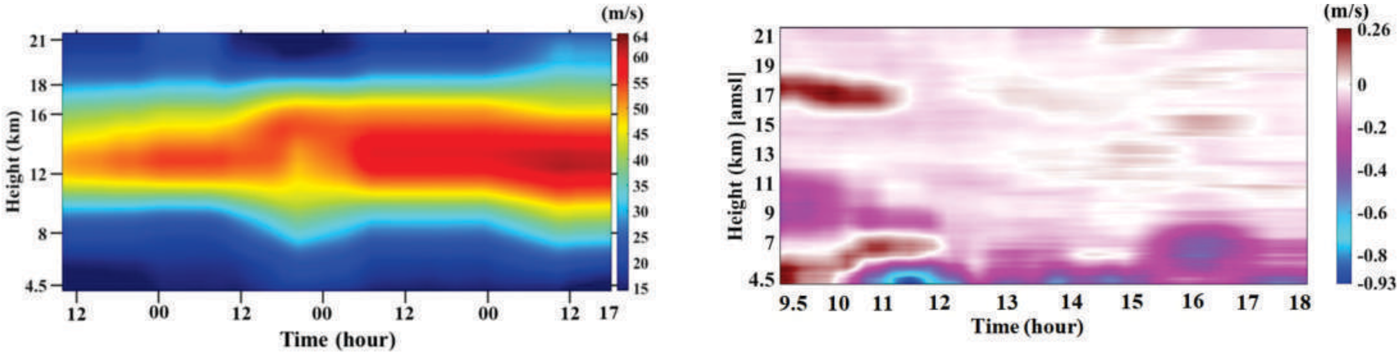
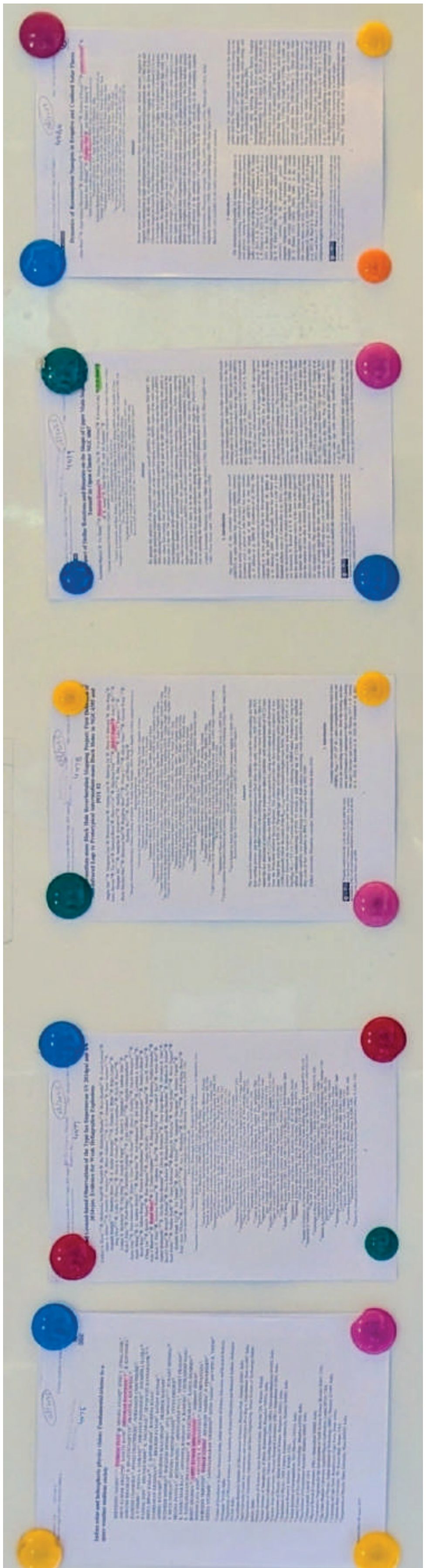



***Figure 52.*** *Left: Time height variation of SWJ from 1- 4 March, 2024. Right: Vertical updraft, downdraft observed on 3 March, 2024.*

# List of Publications



## Referred Journals

### Astronomy & Astrophysics

1. Bandyopadhyay, Avrajit et al. (including **Pandey, Jeewan C.**). (2024). A chemodynamical analysis of bright metal-poor stars from the HESP-GOMPA survey - indications of a non-prevailing site for light r-process elements. *Mon. Not. Roy. Astron. Soc.,* 529, 2191-2207.

2. Singh, Mridweeka et al. (including **Misra, Kuntal**). (2024). SN 2020udy: A New Piece of the Homogeneous Bright Group in the Diverse Iax Subclass. *Astrophys. Jr.,* 965: 73(14pp).

3. **Joshi, Yogesh Chandra, Deepak** & Malhotra, Sagar. (2024). A study on the metallicity gradients in the galactic disk using open clusters. *Front. Astron. Space Sci., 11:* 1348321 (15pp).

4. MAGIC Collaboration; Abe, H. et al. (including **Gupta, A. C.**). (2024). The variability patterns of the TeV blazar PG 1553 + 113 from a decade of MAGIC and multiband observations. *Mon. Not. Roy. Astron. Soc., 529,* 3894–3911.

5. Dastidar, Raya et al. (including **Dukiya, Naveen** & **Misra, Kuntal**). (2024). SN 2019nyk: A rapidly declining Type II supernova with early interaction signatures. *Astron. Astrophys., 685*: A44 (18 pp).

6. Belwal, Kuldeep et al. (including **Dattatrey, Arvind K.** & **Yadav, R. K. S.**). (2024). Exploring NGC 2345: A Comprehensive Study of a Young Open Cluster through Photometric and Kinematic Analysis. *Astron. Jr., 167*: 188 (16 pp).

7. **Singh, Sadhana, Pandey, Jeewan C.** et al. (including **Panwar, Neelam**). (2024). Foreground Dust Properties toward the Cluster NGC 7380. *Astron. Jr., 167*: 242 (16 pp).

8. **Singh, Gurpreet** & **Pandey, J. C.** (2024). AB Dor: Coronal Imaging and Activity Cycles. *Astrophys. Jr., 966*: 86 (14 pp).

9. **Shrivastav, Arpit Kumar** & **Pant, Vaibhav** et al. (including **Banerjee, Dipankar**). (2024). Statistical investigation of decayless oscillations in small-scale coronal loops observed by Solar

Orbiter/EUI. *Astron. & Astrophys., 685*: A36 (11 pp).

10. Oates, S. R. et al. (including **Gupta, R.** & **Pandey, S. B.**). (2024). Swift/UVOT discovery of Swift J221951-484240: a UV luminous ambiguous nuclear transient. *Mon. Not. Roy. Astron. Soc., 530*, 1688–1710.

11. Paulson, Sonu Tabitha, **Mallick, K. K.** & Ojha, D. K. (2024). Unveiling the Cosmic Cradle: clustering and massive star formation in the enigmatic Galactic bubble N59. *Mon. Not. Roy. Astron. Soc., 530*, 1516-1533.

12. Sreedevi, Anu, **Jha, Bibhuti Kumar**, Karak, Bidya Binay & **Banerjee, Dipankar**. (2024). Analysis of BMR Tilt from AutoTAB Catalog: Hinting toward the Thin Flux Tube Model? *Astrophys. Jr., 966*: 112(13pp).

13. Srivastava, A. K., et al. (including **Singh, Balveer**). (2024). Alfvén pulse driven spicule-like jets in the presence of thermal conduction and ion-neutral collision in two-fluid regime. *Philosoph. Trans. Royal Soc. A, 382*: 2272 (pp).

14. **Pandey, Divya**, Kaviraj, Sugata, Saha, Kanak & **Sharma, Saurabh**. (2024). Star formation exists in all early-type galaxies - evidence from ubiquitous structure in UV images. *Mon. Not. Roy. Astron. Soc., 531*, 2223-2236.

15. Valtonen, Mauri J. et al. (including **Gupta, Alok C.** & **Kishore, Shubham**). (2024). Evidence of Jet Activity from the Secondary Black Hole in the OJ 287 Binary System. *Astrophys. Jr. Lett., 968*: L17, (8pp).

16. Singh, Koshvendra et al. (including **Ghosh, Arpan** & **Sharma, Saurabh**). (2024). Accretion Funnel Reconfiguration during an Outburst in a Young Stellar Object: EX Lupi. *Astrophys. Jr., 968*: 88, (28pp).

17. Mandal, Amit Kumar et al. (including **Rakshit, Suvendu**). (2024). Revisiting the Dust Torus Size–Luminosity Relation Based on a Uniform Reverberation-mapping Analysis. *Astrophys. Jr., 968*: 59, (28 pp).

18. Chan, Lami et al. (including **Banerjee, Dipankar**). (2024). Global Coronal Plasma Diagnostics Based on Multislit Extreme-ultraviolet Spectroscopy. *Astrophys. Jr., 967*: 162, (10 pp).

19. **Roy, Abhijit, Joshi, Jagdish C.** et al. (2024). Gamma-rays and neutrinos from giant molecular cloud populations in the galactic plane. *Jr. Cosmo. Astropart. Phys., 2024*: 6 (32 pp).

20. **Majumdar, Satabdwa** et al. (including **Vashishtha, Nitin** & **Banerjee, Dipankar**). (2024). Probing Velocity Dispersion Inside Coronal Mass Ejections: New Insights on Their Initiation. *Astrophys. Jr. Lett., 970*: L17 (13pp).

21. Maurya, Jayanand et al. (including **Joshi, Y. C. & Kumar, B.**). (2024). Origin of extended main-sequence turn-off in open cluster NGC 2355. *Mon. Not. Roy. Astron. Soc., 532,* 1212-1222.

22. **Krishna Prasad, S.** & Van Doorsselaere, T. (2024). Modeling the Propagation of Slow Magnetoacoustic Waves in a Multistranded Coronal Loop. *Astrophys. Jr., 970*: 58 (8pp).

23. Arora, Bharti, De Becker, Michaël & **Pandey, Jeewan C.** (2024). A comprehensive X-ray analysis of the massive O-type binary HD 93250 over two decades. *Astron. & Astrophys., 687*: A34, (13pp).

24. Sahoo, S. K., Baran, A. S. , Németh, P. , Worters, H. L., Pramod Kumar, S. , **Joshi, S.** & Kilkenny, D. (2024). Mode identification and period fitting in six pulsating hot subdwarfs. *Pub. Astron. Soc. Australia., 41,* e041(19pp).

25. Kurian, K. S. ,Stalin, C. S., **Rakshit, S.**, et.al. (2024). A comparative analysis of the active galactic nucleus and star formation characteristics of broad- and narrow-line Seyfert 1 galaxies. *Astron. Astrophy, 688:A32,* (15 pp.).

26. **Panwar, Neelam , Rishi, C., et. al.** (including **Sharma, Saurabh).** (2024). Low-mass Stellar and Substellar Content of the Young Cluster Berkeley 59. *Astron. Jr., 168:89,* (12pp.).

27. **Joshi, Raj Kishor , Chattopadhyay, Indranil** , Tsokaros, Antonios & **Tripathi, Priyesh** . (2024).

Numerical Simulation of Radiatively Driven Transonic Relativistic Jets. *Astrophy. Jr., 971:13,* (13 pp.).

28. Xue, Rui , Wang, Ze-Rui , **Joshi, Jagdish C. &** Li ,Wei-Jian. (2024). Hadronuclear Interactions in Active Galactic Nuclei Jets as the Origin of the Diffuse High-energy Neutrino Background. *Astrophy. Jr., 971:146,* (08 pp.).

29. **Ror, Amit Kumar, Gupta, Rahul**, et. al. (including **Aryan, Amar Pandey & Shashi Bhushan**). (2024). Exploring the Origin of Ultralong Gamma-Ray Bursts: Lessons from GRB 221009A. *Astrophy. Jr., 971: 163,* (26 pp.).

30. Singh, Raghubar , Mallick, Anohita, Reddy, Bacham E., **Pandey, Jeewan C.** & Zhao, Gang. (2024). Study of a Red Clump Giant, KIC 11087027, with High Rotation and Strong Infrared Excess—Evidence of Tidal Interaction for High Lithium Abundance. *Astrophy. Jr. Letters, 971: L3* (26 pp.).

31. Biswas, Samrat, **Medhi, Biman J.,** Deb, Sushmita , Deb, Sukanta , Das, H. S. & Perren, G. I. (2024). A statistical approach to polarimetric and photometric investigation of the intermediate-age open cluster NGC 1912. *Mon. Not. Roy. Astron. Soc., 532,* 1241-1261.

32. **Jose, Jincen, Rakshit, Suvendu**, et. al. (including **Neha, Sharma & Pandey, Shivangi**). (2024). Spectropolarimetric view of the gamma-ray emitting NLS1 1H0323 + 342. *Mon. Not. Roy. Astron. Soc., 532,* 3187-3197.

33. Zhou, Dongtao, Zhang, Zhongli, **Gupta, Alok C.,** et. al. (2024). X-ray flux and spectral variability of the blazar OJ 287 with Suzaku. *Mon. Not. Roy. Astron. Soc., 532,* 3285-3298.

34. **Verma, Aayushi, Sharma, Saurabh**, et. al. (incuding **Kaur, Harmeen , Chand, Tarak & Mamta**).(2024). Investigating the Star-forming Sites in the Outer Galactic Arm. *Astron. Jr., 168:98,* (15pp).

35. Joshi, Arti et al. (including **Rawat, Nikita & Rao, Srinivas M.**). (2024). Unveiling the nature of two dwarf novae: CRTS J080846.2+313106 and V416 Dra, *Astron. Astrophy., 689,* A158 (12 pp).

36. Liodakis, I. et al. (including **Jose, Jincen, Pandey, Shivangi, Rakshit, S.** & **Sharma, Neha**). (2024). Testing particle acceleration in blazar jets with continuous high-cadence optical polarization observations. *Astron. Astrophy., 689,* A200 (9pp).

37. **Sharma, Neha**, Soam, A. & Maheswar, G. (2024). Optical polarimetry study of the Lambda-Orionis star-forming region. *Astron. Astrophy., 689*, A225 (16pp).

38. Rawat, V. et al. (including **Kumar, Brajesh** & **Sharma, S.**). (2024). Peering into the heart of the giant molecular cloud G148.24+00.41: a deep near-infrared view of the newly hatched cluster FSR 655. *Astron. Jr., 168,* 136 (14pp).

39. **Gupta, Rahul, Pandey, S. B.** et al. (including **Ror, Amit** & **Aryan, Amar**). (2024). A detailed time-resolved and energy-resolved spectro-polarimetric study of bright gamma-ray bursts detected by AstroSat CZTI in its first year of operation. *Astrophy. Jr., 972 (2),* 166 (32pp).

40. Raj, Ashish et al. (including **Pandey, J. C.**). (2024). The dusty aftermath of a rapid nova: V5579 Sgr. *Publi. Astron. Soc. of Australia, 41*, e051 (14pp).

41. **Shrivastav, Arpit Kumar, Pant, Vaibhav** & Antolin, Patrick. (2024). Effects of coronal rain on decayless kink oscillations of coronal loops. *Astron. Astrophy., 689,* A295 (12pp).

42. Uppal, N., Ganesh, S., Pelgrims, V., **Joshi, Santosh** & **Sarkar, Mrinmoy**. (2024). Linear polarization study of open clusters in the anticenter direction: signature of the spiral arms. *Astron. Astrophy., 690,* A49 (21pp).

43. **Kishore, S., Gupta, A. C.,** Wiita, P. J. & Tiwari, S. N. (2024 ). Rapid optical flare in the extreme teraelectronvolt blazar 1ES 0229+200 on intraday timescales with the Transiting Exoplanet Survey Satellite. *Astron. Astrophy., 690,* A223 (7pp).

44. **Dimple, Misra, K.**, & Arun, K. G. (2024). Diversity in Fermi/GBM Gamma-Ray Bursts: new insights from machine learning. *Astrophy. Jr., 974,* 55 (8pp).

45. **Pandey, Divya**, Saha, Kanak & Pradhan, Ananta C. (2024). Exploring filament galaxies using AstroSat/UVIT. *Astrophys. Jr, 974,* 117 (12pp).

46. Zuo, W. et al. (including **Gupta, A. C.** & **Kishore, Shubham**). (2024). Optical continuum reverberation mapping of a candidate IMBH in a nearby Seyfert 1 galaxy. *Astrophys. Jr., 978,* 288 (11pp).

47. **Sarkar, Mrinmoy** & **Joshi, Santosh** et al. (2024). Asteroseismology of the mild Am δ Sct star HD 118660: TESS photometry and modelling. *Mon. Not. Roy. Astron. Soc, 534 (4),* 3211-3220.

48. Dainotti, M. G. et al. (including **Misra, K.**). (2024). An optical gamma-ray burst catalogue with measured redshift –I. Data release of 535 gamma-ray bursts and colour evolution. *Mon. Not. Roy. Astron. Soc*, *533*, 4023–4043.

49. **Sharma, Saurabh** & Borissova, Jura. (2024). Metallicity relations in LMC and SMC from the slope of red giant branch stars in globular cluster. *Eur. Phys. Jr. Spec. Top., 233,* 2877–2884.

50. Kundu, A. & **Joshi, Jagdish C.** et al. (2024). Spatio-spectral-temporal modelling of two young pulsar wind nebulae. *Mon. Not. Roy. Astron. Soc* , *535* , 2415–2435.

51. **Rawat, Nikita** et al. (including **Pandey, J. C.**). (2024). Indications of magnetic accretion in Swift J0826.2−7033. *Astron. Astrophy., 691,* A264 (10pp).

52. Nayak, S. S. et al. (including **Shrivastav, Arpit Kumar**. (2024). Exploring the magnetic and thermal evolution of a coronal jet. *Astrophy. Jr., 975,* 143 (15pp).

53. **Routh, Srinjana** et al. (including **Mishra, Dibya Kirti, Pant, Vaibhav** & **Banerjee, D.**). (2024). Exploring the dynamic rotational profile of the hotter solar atmosphere: a multiwavelength approach using SDO/AIA data. *Astrophy. Jr., 975,* 158 (13pp).

54. Zhang, Z. et al. (including **Aryan, Amar**). (2024). He-accreting oxygen–neon white dwarfs and accretion-induced collapse events. *Astrophy. Jr., 975,* 186 (7pp).

55. Sanjay. Y. et al. (including **Prasad, Krishna S.** & **Banerjee, D.**). ( 2024 ). On the formation height of low-corona and chromospheric channels of the Atmospheric Imaging Assembly (AIA) onboard the Solar Dynamics Observatory (SDO). *Astrophy. Jr., 975,* 236 (11pp).

56. Yin, Yi-Han Iris et al. (including **Pandey, S. B.**). (2024). Triggering the Untriggered: the first Einstein probe-detected Gamma-Ray Burst 240219A and its implications. *Astrophy. Jr. Letters, 975,* L27 (12pp).

57. **Dukiya, Naveen** et al. (including **Misra, K.** & **Ailawadhi, Bhavya**). (2024). Probing the circumstellar environment of the highly luminous Type IIn Supernova ASASSN-14il. *Astrophy. Jr., 976,* 86 (21pp).

58. Shao, Yi-Xuan et al. (including **Pandey, S. B.**). (2024). GTC Optical/Near-infrared upper limits and NICER X-Ray analysis of SGR J1935+2154 for the outburst in 2022. *Astrophy. Jr., 976,* 99 (12pp).

59. **Pandey, Shivangi, Rakshit, Suvendu** et al. (including **Jose, Jincen**). (2024). Spectrophotometric reverberation mapping of intermediate-mass black hole NGC 4395. *Astrophy. Jr., 976* , 116 (13pp).

60. Kapadia, Shasvath J. et al. (including **Misra, K.** & **Jain, Dhruv**). (2024). Rates and beaming angles of gamma-ray bursts associated with compact binary coalescences. *Astrophys. Jr. Letters, 976,* L10 (7pp).

61. Unni, Athira et al. (including **Joshi, Yogesh C.**). (2024). Low-resolution transit spectroscopy of three hot Jupiters using the 2 m Himalayan Chandra Telescope. *Mon. Not. Roy. Astron. Soc, 535,* 1123–1135.

62. Yang, Fan et al. (including **Joshi, Yogesh C.**). ( 2024). Transit timing variation of K2-237b: hints toward planet disc migration. *Mon. Not. Roy. Astron. Soc. Letters, 535,* L7–L12.

63. Bharathan, Athira M. et al. (including **Wani, Kiran,**

**Joshi, Santosh** & **Pandey, J. C.**) (2024). Simultaneous X-Ray and optical polarization observations of the blazar Mrk 421. *Astrophy. Jr., 975,* 185 (7pp).

64. Sánchez-Ramírez, R. et al. (including **Pandey, S. B., Ror, Amit Kumar** & **Aryan, Amar**). (2024 ). Early photometric and spectroscopic observations of the extraordinarily bright INTEGRAL detected GRB221009A. *Astron. & Astrophy., 692,* A3 (14pp).

65. Raiteri, C. M. et al. (including **Gupta, A. C.**). (2024). A wiggling filamentary jet at the origin of the blazar multi-wavelength behavior. *Astrono. Astrophy., 692,* A48 (14pp).

66. Hernández-García, L. et al. (including **Ailawadhi, B.** & **Misra, Kuntal**). **(**2024). AT 2021hdr: A candidate tidal disruption of a gas cloud by a binary super massive black hole system. *Astrono. Astrophy., 692,* A84 (16pp).

67. Sun, Tian-Rui et al. (including **Pandey, S. B.**). (2024). GRB 240529A: a tale of two shocks. *Astrophy. Jr. Letters, 676,* L20 (10pp).

68. Ram, Bhinva et al. (including **Pant, Vaibhav**). (2024). Transition region brightening in a moss region and their relation with lower atmospheric dynamics. *Astrophy. Jr.*, 977, 25 (10pp).

69. Gutiérrez, Claudia P. et al. (including **Misra, Kuntal**). (2024). CSS 161010: a luminous fast blue optical transient with broad blueshifted hydrogen lines. *Astroph. Jr., 977,* 162 (21pp).

70. Tripathi, Ashutosh & **Gupta, A. C.** et al. (2024). Revisiting radio variability of the Blazar 3C 454.3. *Astroph. Jr.*, 977, 166 (13pp).

71. Piridi, Sonika, Kumar, Ranjan, **Pandey, Divya**, Pradhan, Ananta C. (2024). A comprehensive catalog of UVIT Observations. I. catalog description and first release of source catalog (UVIT DR1). *Astroph. Jr. Suppl. Sr., 275,* 34 (18pp).

72. **Deepak**. (2024). Stellar substructures in the Galactic disc and halo: properties, origins, and evolution. *Jr. Astroph. Astron.*, 45, 25 (23pp).

73. Kundu, A. & **Joshi, Jagdish C.** et al. (2024). Spatio-spectral-temporal modelling of two young pulsar wind nebulae. *Mon. Not. Roy. Astron. Soc, 535,* 2415–2435.

74. **Jha, Bibhuti Kumar** et al. (including **Banerjee, D.** & **Priyadarshi, Aditya**). (2024). Butterfly diagram and other properties of plage areas from Kodaikanal Ca ii K photographs covering 1904 – 2007. *Solar Physics , 299,* 166 (22pp).

75. Damian, Belinda et al. (including **Panwar, Neelam**). (2024). Twins in diversity: understanding circumstellar disc evolution in the twin clusters of W5 complex. *Mon. Not. Roy. Astron. Soc., 535,* 1321–1337.

76. Basak, D. et al. (including **Roy, Abhijit**). (2024). Experimental study of α- induced reactions on 113In for the astrophysical p process. *Physical Rev. C, 110,* 065807 (10pp).

77. Didel, Shweta, **Pandey, Jeewan C.**, Srivastava, A. K. (2025). Characterizing Superflares in HR 1099 Using Temporal and Spectral Analysis of XMM-Newton Observations. *Astron. Jr.*, *169,* 49 (10pp).

78. **Shrivastav, Arpit Kumar** & **Pant, Vaibhav** (including **Banerjee, D.**). (2025). On the existence of long-period decayless oscillations in short active region loops. *Astroph. Jr., 979,* 6 (14pp).

79. **Tripathi, Priyesh Kumar, Chattopadhyay, Indranil** & **Joshi, Raj Kishor**. (2025). On disk formation around isolated black holes via stream accretion. *Astrophy. Jr., 979*: 61 (11pp).

80. **Dogra, Karan** & **Gupta, Alok C.** et al. (2025). Multiband optical variability of the Blazar 3C 454.3 on diverse timescales. *Astroph. Jr. Suppl. Sr., 276,* 1 (14pp).

81. Mookerjea, Bhaswati et al. (including **Sharma, Saurabh, Panwar, Neelam** & **Sahu, Dipen**. (2025). Research on the interstellar medium and star formation in the Galaxy: An Indian perspective. *Jr. Astrophy. Astron., 46,* 3 (26pp).

82. Zhu, Li-Tao et al. (including **Devanand, P. U., Gupta, A. C.** & **Dogra, Karan**). (2025). Testing colour–magnitude pattern as a method in the search

for changing-look AGNs. *Mon. Not. Roy. Astron. Soc., 536,* 2715–2729.

83. **Singh, Gurpreet, Pandey, J. C.**, Yadava, Umesh. (2025). A study of an X-ray flare on the solar analogue V895 Tau. *New Astronomy, 114,* 102295 (7pp).

84. **Surdej, J.,** Hickson, P., **Misra, K. , Banerjee, D., & Ailawadhi, B.** et al. (including **Dubey, Monalisa, Dukiya, N., Kharayat, M., Kumar, H., Kumar, M., Kumar, T. S., Kumari, P., Prabhavu, S., Pranshu, K., Rawat, H., Reddy, B. K., Pillai, A. S. & Singh, K.**). ( 2025). The 4 m International Liquid Mirror Telescope: construction, operation, and science. *Astron. Astrophy., 694,* A80 (11pp).

85. Dastidar, R., **Misra, K.** et al. (2025). SN 2018is: A low-luminosity Type IIP supernova with narrow hydrogen emission lines at early phases. *Astron. Astrophy., 694,* A260 (18pp).

86. Bhadari, N. K. et al. (including **Sharma, S.**). ( 2025). JWST-ALMA study of a hub-filament system in the nascent phase. *Astron. Astrophy., 694,* L18 (8pp).

87. Maity A. K. et al. (including **Sharma, S.**). (2025). G321.93-0.01: a rare site of multiple hub-filament systems with evidence of collision and merging of filaments. *Astron. Jr., 169,* 56 (20pp).

88. Devangan, L. K. et al. (including **Sharma, S.**). (2025). Mon R2: a hub–filament system with an infrared bubble at the hub center. *Astron. Jr., 169,* 80 (18pp).

89. Ryde, Nils & **Nandakumar, Govind** et al. (2025). Chemical abundances in the nuclear star cluster of the milky way: alpha-element trends and their similarities with the inner bulge. *Astroph. Jr., 979,* 174 (14pp).

90. Zuo, Wenwen & **Gupta, Alok C.** et al. (2025). Spectral Energy Distribution Variability of the Blazar OJ287 During 2009–2021. *Astrophy. Jr., 979,* 210 (12pp).

91. Jadhav, O. R., Dewangan, L. K., **Verma, Aayushi**, Bhadari, N. K., Maity, A. K., **Sharma, Saurabh, Mamta**. (2025). Uncovering the hidden physical structures and protostellar activities in the low-metallicity S284-RE region: results from ALMA and JWST. *Astroph. Jr., 980,* 133 (14pp).

92. Ram, Diya, Mondal, Soumen, Patra, Dusmanta, **Ghosh, Samrat**, Khumbhakar, Rajib. (2025). Magnetic activities of AD Leonis: flares in TESS data and optical spectra. *Astroph. Jr., 980,* 196 (13pp).

93. Ravindra, Belur et al. (including **Banerjee, D.**). (2025). Study of Wind pattern at the incursion site of Pangong Tso near Merak Village. *Experimental Astronomy, 59,* 4 (24pp).

94. Sivarani, T. et al. (including **Joshi, Y. C.**). (2025). Stars and stellar populations in Milky Way and the nearby galaxies. *Jr. Astrophy. Astron., 46,* 15 (19pp).

95. Jadoliya, Vishal, **Pandey, Jeewan C.**, Tej, Anandmayee. (2025). X-ray study of WR 48-6: A possible colliding wind binary. *Jr. Astrophy. Astron., 46,* 16 (12pp).

96. Bagla, J. S. et al. (including **Pandey, S. B.**). (2025). Human resource development in astronomy: An Indian perspective. *Jr. Astrophy. Astron., 46,* 18 (9pp).

97. Valerin, G. et al. (including **Misra, K.**). (2025). A study in scarlet: I. Photometric properties of a sample of intermediate-luminosity red transients. *Astron. Astrophy., 695,* A42 (23pp).

98. Valerin, G. et al. (including **Misra, K.**). (2025). A study in scarlet: II. Spectroscopic properties of a sample of intermediate-luminosity red transients. *Astron. Astrophy., 695,* A43 (27pp).

99. **Ghosh, Samrat** et al. (including **Joshi. S. & Lata, Sneh**). (2025). Dynamic photometric variability in three young brown dwarfs in taurus: detection of optical flares with TESS data. *Astroph. Jr.*, 981, 75 (23pp).

100. Laha, Sibasish et al. (including **Rakshit, Suvendu**). (2025). Multiwavelength observations of a jet launch in real time from the post-changing-look active galaxy 1ES 1927+654. *Astroph. Jr.*, 981, 125 (20pp).

101. Kumbhakar, Rajib, Mondal, Soumen, **Ghosh, Samrat** & Ram, Diya. (2025). Starspot distribution and flare events in two young low-mass stars using TESS data. *Astroph. Jr., 981,* 169 (22pp).

102. **Gaur, Haritma** et al. (including **Wani, Kiran**). (2025). Signature of a Seyfert-like component in Blazar 3C 273 and its reflection-based explanation. *Astroph. Jr., 981,* 186 (12pp).

103. Chakyar, Sreelakshmi P., **Prabhavu J, Sarath**, & Resmi, Lekshmi. (2025). Effect of viewing angle in gamma-ray burst properties. *Astroph. Jr., 982,* 57 (9pp).

104. **Nandakumar, Govind** et al. (2025). The First Chemical Census of the Milky Way's Nuclear Star Cluster. *Astroph. Jr. Letters, 982,* L14 (8pp).

105. Gangopadhyay, Anjasha, **Dukiya, Naveen** et al. (including **Misra, K.**). (2025). SN 2021foa: the bridge between SN IIn and Ibn. *Mon. Not. Roy. Astron. Soc*, *537,* 2898–2917.

106. **Pranshu, Kumar, Misra, Kuntal, Ailawadhi, Bhavya, Dubey, Monalisa** & **Dukiya, Naveen** et al. (2025). PyLMT: a transient detection pipeline for the 4-m International Liquid Mirror Telescope. *Mon. Not. Roy. Astron. Soc. , 538,* 133–152.

107. Caballero-García, M. D. et al. (including **Pandey, S. B.** & **Ror, Amit Kumar**). (2025). X-ray and gamma-ray timing of GRB 180720B, GRB 181222B, GRB 211211A, and GRB 220910A observed with Fermi and ASIM. *Mon. Not. Roy. Astron. Soc. Letters, 538,* L100–L108.

108. Brivio, R. et al. (including **Pandey, S. B.**). (2025). A comprehensive broadband analysis of the high-redshift GRB 240218A. *Astron. Astrophy., 695,* A239 (22pp).

109. Tripathi, D. et al. (including **Banerjee, D.**). (2025). The Solar Ultraviolet Imaging Telescope on Board Aditya-L1. *Solar Physics, 300,* 30 (34pp).

110. **Chandra, Amar Deo**. (2025). Long-term spin-down and low luminosity regime in the Be/X-ray binary pulsar GX 304-1. *Pub. Astron. Soc. Australia, 42,* e037 (16pp).

111. **Bangia, Tarun.** (2025). Articulating cognitive knowledge and experiences for a telescope-building project. *Jr. Res. Engineering and Applied Sciences, 10 (1)*, 846-855.

## Atmospheric Science

1. Patgiri, Dipjyoti et al. (including **Yadav, Virendra**). (2024). A case study on multiple self-interactions of MSTID bands: New insights. *Adv. Space Res., 73,* 3595-3612.

2. Rathi, Rahul et al. (including **Yadav, Virendra**). (2024). Unusual simultaneous manifestation of three non-interacting mid-latitude ionospheric plasma structures. *Adv. Space Res.,* 73, 3550-3562.

3. Chetna et al. (including **Rawat, Vikas** & **Singh, Narendra**). (2024). Long-term meteorology-adjusted and unadjusted trends of PM2.5 using the AirGAM model over Delhi, 2007–2022. *Atmos. Environ: X, 22*: 100255 (14pp).

4. Jadhav, Ashwin Vijay et al. (including **Dumka, Umesh Chandra**). (2024). Spatiotemporal Assessment of Surface Solar Dimming in India: Impacts of Multi-Level Clouds and Atmospheric Aerosols. *Climate,* 12: 48 (17pp).

5. Chetna et al. (including **Singh, Narendra**). (2024). Decoding temporal patterns and trends of PM10 pollution over Delhi: a multi-year analysis (2015-2022). *Environ Monit Assess, 196*: 500 (18pp).

6. **Rajwar, Mahendar Chand, Naja, Manish** & **Srivastava, Priyanka** et al. (2024). Online observation of light non-methane hydrocarbons (C2–C5) over the central Himalayas: Influence of the Indo-Gangetic Plain region. *Atmos. Pollu. Res., 15*: 102078 (15 pp).

7. **Rajput, Akanksha, Singh, Narendra, Singh, Jaydeep** & Rastogi, Shantanu. (2024). Insights of Boundary Layer Turbulence Over the Complex Terrain of Central Himalaya from GVAX Field Campaign. *Asia-Pac. Jr. Atmos. Sci, 60:* 143 (22 pp).

8. Thilakan, V. et al. (including **Naja, Manish**). (2024). Potential of using $CO_2$ observations over India in a regional carbon budget estimation by improving the

modelling system. *Atmos. Chem. Phys., 24,* 5315-5335.

9. **Rajput, Akanksha, Singh, Narendra, Singh, Jaydeep, Kumar, Ashish**, & Rastogi, Shantanu. (2024). Dynamical and Microphysical Aspects of Two Distinct Precipitation Systems in the Himalayas With 206.5 MHz Radar and WRF Model. *Earth Space Sci., 11*: e2023EA003213, (21 pp).

10. Jadhav, Ashwin Vijay, Bhawar, Rohini L., **Dumka, Umesh Chandra** et al. (2024). Impacts of meteorological conditions on the plummeting surface-reaching solar radiation over a sub-tropical station – Pune, India. *Energy Sustain. Develop., 80*: 101444 (11pp).

11. Belikov, Dmitry A. et al. (including **Naja, Manish**). (2024). Assessment of the impact of observations at Nainital (India) and Comilla (Bangladesh) on the CH4 flux inversion. *Prog. Earth Planet. Sci., 11*: 36 (17pp).

12. Kimothi, S., Bhatt, V., Kumar, S., Gupta, A., & **Dumka, U. C.** (2024). Statistical behavior of the European Energy Exchange-Zero Carbon Freight Index (EEX-ZCFI) assessments in the context of Carbon Emissions Fraction Analysis (CEFA). *Sustainable Futures, 7,* 100164 (10pp).

13. Patgiri, D., Rathi, R., **Yadav, Virendra**, et. al. (2024). A Rare Simultaneous Detection of a Mid-Latitude Plasma Depleted Structure in O(1D) 630.0 and O(1S) 557.7 nm All-Sky Airglow Images on a Geomagnetically Quiet Night. *Geophys. Res. Lett., 51(14),* e2023GL106900 (11pp.).

14. Goswami, M. et al. (including **Singh, Narendra**). (2024). Seasonal variation assessment of ambient air quality during COVID-19 lockdown in Uttarakhand state, India. *Mausam, 75 (3)*, 703-714.

15. Latif, Mohd Talib, et. al. (including **Naja, Manish**). (2024). In-depth analysis of ambient air pollution changes due to the COVID-19 pandemic in the Asian Monsoon region. *Sci. Total Enviro., 941,* 173145 (26pp.).

16. **Rajwar, Mahendra Chand, Naja, Manish,** Kant, Y., **Rawat, Prajjwal, Tomar, Vikrant,** Tiwari, R. K. & Lal, S. (2024). Ozone variability, its formation potential and crops losses in the Himalayan foothills. *Air Quali. Atmos. Health, 17*, 2263-2276.

17. **Sheoran, Rahul, Dumka, U. C.**, Tiwari, R. & Hooda, R. K. (2024). An improved version of the prewhitening method for trend analysis in the autocorrelated time series. *Atmosphere, 15,* 1159 (15pp).

18. Budhirajaa, Twinkle et al. (including **Dumka, U. C.**). (2024). Low temperature physical activation of raw charcoal for excellent dye adsorption kinetics. *Fullerenes, Nanotubes and Carbon Nanostructures, 33 (5)*, 441–455.

19. **Rawat, Prajjwal, Naja, Manish, Rajwar, Mahendar C.** et al. (including **Kumar, Mukesh**). (2024). Long-term observations of $NO_2$, $SO_2$, HCHO, and CHOCHO over the Himalayan foothills: Insights from MAX-DOAS, TROPOMI, and GOME-2. *Atmos. Environ., 336,* 120746 (14pp).

20. Vichare, Geeta et al. (including **Yadav, Virendra**). (2024). Low-latitude Auroras: insights from 2023 April 23 Solar Storm. *Astroph. Jr., 977,* 171 (14pp).

21. Patidar, Kalpana, Alluhayb, Abdullah H., Younis, Alaa M., **Dumka, U. C.** & Ambade, Balram. (2024 ). Investigation of microplastic contamination in the gastrointestinal tract of fish: a comparative study of various freshwater species. *Physics and Chemistry of the Earth, Parts A/B/C, 136,* 103760 (9pp).

22. Patgiri, D. et al. (including **Yadav, Virendra**). (2024). Role of coupled electrodynamics of E- and F-regions on the rapid poleward extension of EMSTID fronts. *JGR:Space Phy., 129,* e2024JA032991 (17pp).

23. **Bhattacharjee, S., Naja, Manish,** Rawat, K. S., & Tripathi, V. K. (2024). Influence of the Western Disturbance on Winter Precipitation: Observations over the Central Himalayas using VHF Radar. *Environment and Ecology, 42(4),* 1615–1622.

24. **Rajwar, Mahendar Chand, Naja, Manish, Rawat, Prajjwal,** Venkataramani, S., Tiwari. R. K. (2024). Health impacts, ozone and secondary

organic aerosol formation potential of aromatic hydrocarbons ($C_6$-$C_8$) in the Central Himalayas and the Indo-Gangetic Plain. Enviro. Sci. Pollu. Res., 32 (3): 1525–1540.

25. Nayagam, Lorna et al. (including **Naja, Manish)**. (2025). Indian land carbon sink estimated from surface and GOSAT observations. *Remote Sensing, 17*, 450 (21pp).

26. **Rawat, Vikas** & **Singh, Narendra** et al. (2025). Insights into aerosol vertical distribution, subtype, and secondary particle formation in central Himalayas: A COVID-19 lockdown perspective. *Atmos. Environ., 343,* 121015 (17pp).

27. Patidar, Kalpana et al. (including **Dumka U. C.**). (2025). Assessing the microplastic pandemic: Prevalence, detection, and human health impacts in Asian aquatic environments. *Physics and Chemistry of the Earth*, *Parts A/B/C, 137,* 103800 (17pp).

## Book Chapter

1. Sharma, Kiran et al. (including **Singh, Narendra**). (2024). Assessment of Ozone Pollution in the Foothills of the Central Himalayan Valley. *Climate Crisis and Sustainable Solutions*.227-232pp.

## Circulars/Bulletins/Conference Proceedings

**1. Rawat, Vikas** & **Singh, Narendra** et al. (2024). Exploring aerosol dynamics in Central Himalaya during North Indian biomass burning event-2022. *IEEE-IGARSS,* 2024.

**2.** Shah, Harshit et al. (including **Nanjappa, Nandish, Sharma, Saurabh, Bangia, T., Reddy, Krishna** & **Jaiswar, Mukesh**). (2024). Mechanical design of the pick-up arm prototype for TIFR-ARIES Multi-Object Optical to Near Infrared Spectrometer (TA-MOONS). *Proc. Of SPIE, 13096*, 130968P (11pp).

**3.** Poojary, S. S. et al. (including **Reddy, Krishna B., Sharma, Saurabh,** & **Udhwani, Purvi**). (2024). Front optics design of TIFR-ARIES Multi-Object Optical to Near Infrared Spectrometer (TA-MOONS). *Proc. Of SPIE, 13096*, 130968S (13pp).

**4.** Glauser, Adrian M. et al. (including **Dawn, Arjun**). (2024). The Large Interferometer For Exoplanets (LIFE): a space mission for mid-infrared nulling interferometry. *Proc. Of SPIE, 13095*, 130951D (21pp).

**5. Mishra, Dibya Kirti, Routh, Srinjana,** Jha, Bibhuti Kumar, Chatterjee, Subhamoy, **Banerjee, Dipankar.** (2024). Differential rotation of the solar chromosphere using multidecadal Ca II K spectroheliograms. *Proc. IAU Symposium no. 365,* 31-35.

**6.** Sreedevi, Anu, Jha, Bibhuti Kumar, Karak, Bidya Binay & **Banerjee, Dipankar**. (2024). AutoTAB: an algorithm to track bipolar magnetic regions and initial results from the tracked BMRs. *Proc. IAU Symposium no. 365,* 332-339.

**7.** Jha, Bibhuti Kumar, Sreedevi, Anu B., Karak, Bidya Binay & **Banerjee, Dipankar**. (2024). Exploring the quenching of bipolar magnetic region tilts using AutoTAB. *Proc. IAU Symposium no. 365,* 345-349.

8. **Joshi, Santosh** et al. (including **Panday, Jeewan Chandra**, **Misra, Kuntal**). (2024). Proceeedings of the 3rd BINA workshop on the scientific potential of the Indo-Belgian cooperation. *Bull. Soc. R. Sci. Liège, 93(2),* 1–31.

9. **Udhwani, Purvi**, Omar, Amitesh and **Reddy, Krishna**. (2024). Assembly and testing of Ground Layer Adaptive Optics (GLAO) for ARIES telescope. *Bull. Soc. R. Sci. Liège, 93(2),* 89–95.

10. Tej, Anandmayee, Sicardy,Bruno, Ashok, Nagarhalli Madhav & **Sharma, Saurabh**. (2024). Stellar occultations with the 3.6-m DOT: probing planetary atmospheres. *Bull. Soc. R. Sci. Liege, 93(2),* 112–122.

11. **Panchal, Alaxender** & **Joshi, Yogesh Chandra**. (2024). Characterization of the eclipsing binary system EPIC 211982753. *Bull. Soc. R. Sci. Liège, 93(2)*, 134–145.

12. **Singh, Gurpreet**, **Panday, Jeewan Chandra** & Yadav, Umesh. (2024). Coronal modulation in the ultra-fast rotator LO Peg. *Bull. Soc. R. Sci. Liège, 93(2)*, 146–154.

13. Uppal, Namita et al. (including **Joshi, Santosh**, **Sarkar, Mrinmoy** & **Dileep, Athul**). (2024). Optical polarisation study of galactic open clusters. *Bull. Soc. R. Sci. Liège, 93(2),* 155–169.

14. Panthi, Anju et al. (including **Panday, Sindhu**). (2024). Study of blue metal-poor stars using UVIT/AstroSat. *Bull. Soc. R. Sci. Liège*, *93(2*), 215–226.

15. **Dileep, Athul**, **Joshi, Santosh** & Wayne, Kurtz Donald. (2024). Tess exploration of targets investigated for the Nainital-cape survey project. *Bull. Soc. R. Sci. Liège*, *93(2),* 227–235.

16. **Panday, Jeewan Chandra**, **Rawat, Nikita, Rao, Srinivas M** & Singh, Sadhana. (2024). X-ray Observations of the intermediate polar TX Col .*Bull. Soc. R. Sci. Liège*, 93(2), 243–249.

17. Vaidya, Kaushar, et al. (including **Panday, Sindhu**). (2024). Blue straggler stars of NGC 7789 and NGC 2506 using AstroSat /UVIT (2024). *Bull. Soc. R. Sci. Liège, 93(2),* 250–261.

18. **Sarkar, Mrinmoy, Joshi, Santosh** & De,Cat Peter, Amplitude modulation in a δ Sct Star HD 118660. (2024). *Bull. Soc. R. Sci. Liège*, 93(2), 285–293.

19. **Dattatrey, Arvind Kumar**, **Yadav, Ramakant Singh**, Subramaniam, Annapurni & Singh, Ravi Shankar. (2024).UVIT/AstroSat investigation of a low-luminous blue straggler star in NGC 362: Detection of an extremely low-mass white dwarf as companion. *Bull. Soc. R. Sci. Liège, 93(2)*, 300–307.

20. **Singh, Sadhana**, **Panday, Jeewan Chandra**, Joshi,Vishal. (2024). Polarimetric approach towards membership probability of open star cluster NGC 2345. *Bull. Soc. R. Sci. Liège*, *93(2),* 308–314.

21. **Lata, Sneh**, **Dileep, Athul** et al. (including **Joshi, Santosh**, **Panwar, Neelam, Yadav, Ramakant Singh).** (2024). Detection of variable stars in the galactic globular cluster M15. *Bull. Soc. R. Sci. Liège, 93(2),*315–326.

22. **Rao, Srinivas M**, **Panday, Jeewan Chandra, Rawat, Nikita.** (2024).Timing analysis of the intermediate polar V709 Cas. *Bull. Soc. R. Sci. Liège*, *93(2)*, 327–332.

23. Karmakar, Subhajeet, **Panday, Jeewan Chandra,** et al. (including **Rawat, Nikita**, **Singh, Gurpreet).**(2024). AstroSat investigation of X-ray flares on two active K-M systems: CC Eri and AB Dor. *Bull. Soc. R. Sci. Liège,* 93(2), 333–340.

24. Karmakar, Subhajeet, et al. (including **Pandey, Jeewan Chandra).** (2024). Near-UV and optical spectroscopic investigation of late-type stars from the MIRA/Oliver Observing Station. *Bull. Soc. R. Sci. Liège, 93(2),* 341–350.

25. **Joshi, Yogesh Chandra** and **Panchal, Alaxender.** (2024). Investigation of orbital period changes in nine contact binaries. *Bull. Soc. R. Sci. Liège, 93(2),* 351–357.

26. Ram, Diya et al. (including **Joshi, Santosh**). (2024).Understanding the magnetic activity of M Dwarfs: Optical and near-infrared spectroscopic studies. *Bull. Soc. R. Sci. Liège, 93(2)*, 358–369.

27. Adassuriya, Janaka, et al. (including **Joshi, Santosh**). (2024).Curve of growth analysis of SZ Lyn. *Bull. Soc. R. Sci. Liège*. 93(2), 470–477.

28. Arora, Bharti, Becker, Michaël De and **Panday, Jeewan Chandra** (2024). Multiwavelength view of massive binaries. *Bull. Soc. R. Sci. Liège*, *93(2)*, 478–490.

29. Banerjee, Gourav, et al. (including **Joshi, Santosh**). (2024). Study of the balmer decrements for galactic classical be stars using the Himalayan Chandra Telescope of India. *Bull. Soc. R. Sci. Liège, 93(2*), 504–513.

30. Yadav, Abhay Pratap, et al. (including **Joshi, Yogesh Chandra** & **Joshi, Santosh). (**2024). Study of instabilities and outbursts in the Luminous Blue Variables AF And and R 127. *Bull. Soc. R. Sci. Liège*, *93(2)*, 528–535.

31. Parida, Sugyan, Yadav, Abhay Pratap and **Joshi, Santosh.**(2024).Instabilities in models of

supergiants MWC 137 and MWC 314. *Bull. Soc. R. Sci. Liège, 93(2)*, 552–559.

32. **Ghosh, Arpan**, **Sharma, Saurabh** et al. (including **Verma, Aayushi** & **Sahu ,Tarak Chand**).(2024). Initial results of our spectro-photometric monitoring of XZ Tau. *Bull. Soc. R. Sci. Liège,* 93(2), 560–571.

33. **Verma, Aayushi**, **Sharma, Saurabh** & Dewangan, Lokesh. (2024) Extraction of YSO cores and active regions near the Star-forming Site AFGL 5157. *Bull. Soc. R. Sci. Liège*, 93(2), 582–588.

34. Chakraborty, Soumita, et al. (including **Joshi, Santosh**). (2024).Census of young stars in galactic star forming region Sh2-88. *Bull. Soc. R. Sci. Liège, 93(2),*613–622.

35. Ghosh, Samrat, et al. (including **Joshi, Santosh** & **Lata, Sneh**).(2024). Photometric variability of low mass stars and brown dwarfs in IC 348 and taurus star forming regions. *Bull. Soc. R. Sci. Liège, 93(2),* 623–635.

36. Bhattacharyya, Suman, et al. (including **Joshi, Santosh**). (2024). Insights on the optical and infrared nature of MAXI J0709-159: Implications for high-mass X-ray binaries. *Bull. Soc. R. Sci. Liège, 93(2)*, 636–647.

37. **Rawat, Nikita**, **Panday, Jeewan Chandra** et al. (including, **Rao, Srinivas M.**). (2024). A preliminary timing analysis of two intermediate polars: UU col and swift J0939.7-3224. *Bull. Soc. R. Sci. Liège, 93(2)*, 648–656.

38. **Dimple**, **Misra, Kuntal** & Yadav, Lallan. (2024). Investigating high redshift short GRBs: signatures of collapsars? *Bull. Soc. R. Sci. Liège 293(2)*, 670–682.

39. **Gupta, Rahul**, **Panday, Shashi Bhushan** et al. (including **Ror, Amit Kumar** & **Aryan, Amar**.(2024). Recent observations of peculiar gamma-ray bursts using the 3.6-m Devasthal Optical Telescope (DOT). *Bull. Soc. R. Sci. Liège , 93(2)*,683–699.

40. **Aryan, Amar**, **Panday, Shashi Bhushan**, et al. (including **Rahul, Gupta** & **Amit, Kumar Ror**). (2024). Evolution and final fates of a rotating 25 M⊙ Pop III Star. *Bull. Soc. R. Sci. Liège, 93(2* ,700–708.

41. **Ror, Amit Kumar**, **Panday, Shashi Bhushan** et al. (including **Gupta, Rahul** & **Aryan, Amar**).(2024). Magnetar central engine powering the energetic GRB 210610B? *Bull. Soc. R. Sci. Liège* , 93(2),709–718.

42. **Ghosh, Ankur**, **Misra, Kuntal** & **Dimple**. (2024). Prompt emission properties of GRB 200613 A. *Bull. Soc. R. Sci. Liège*, 93(2), 719–726.

43. **Misra, Kuntal**, **Dimple** & **Ghosh, Ankur**. (2024). Insights into the properties of GRBs with TeV emission. *Bull. Soc. R. Sci. Liège*, 93(2), 727–737.

44. **Chand, Krishan. (**2024). Intranight variability of ultraviolet emission from High-z blazars. *Bull. Soc. R. Sci. Liège,* 93(2) 738–751.

45. Jalan, Priyanka, et al. (including **Negi, Vibhore**). (2024). GraL spectroscopic identification of multiply imaged quasars. *Bull. Soc. R. Sci. Liège*, 93(2), 752–765.

46. **Jha, Vivek Kumar**, Joshi, Ravi, Saraswat, Jayesh & Chand, Hum. (2024). Exploring the AGN accretion disks using continuum reverberation mapping. *Bull. Soc. R. Sci. Liège*, 93(2), 766–779.

47. **Panday, Shivangi**, **Rakshit, Suvendu**, **Jalan, Priyanka** & **Chand, Krishan.** (2024). Spectroscopic and photometric study of the low-luminous AGN NGC 4395. *Bull. Soc. R. Sci. Liège*, 93(2), 797–810.

48. **Ailawadhi, Bhavya**, **Dubey, Monalisa**, **Dukiya, Naveen**, et al. (including **Kumar, Brajesh** , **Misra, Kuntal**, **Negi, Vibhore**, **Pranshu, Kumar**).(2024). An automated photometric pipeline for the ILMT data. *Bull. Soc. R. Sci. Liège*, 93(2), 820–827.

49. **Kumar, Pranshu**, **Ailawadhi, Bhavya** et al. (including **Dubey, Monalisa**, **Dukiya, Naveen**,

**Kumar, Brajesh**, **Misra, Kuntal**, **Negi, Vibhore**). (2024). Automated Transient Detection in the context of the 4 m ILMT. *Bull. Soc. R. Sci. Liège*, 93(2), 828–836.

50. **Dukiya, Naveen**, **Ailawadhi, Bhavya** et al. (including **Dubey, Monalisa**, **Kumar, Brajesh**, **Misra, Kuntal**, **Vibhore, Negi**, **Kumar, Pranshu**).(2024). Astrometric and photometric calibrators for the 4-m International Liquid Mirror Telescope. *Bull. Soc. R. Sci. Liège*, 93(2), 837–854.

51. Cat Peter De, Becker, Michaël, De & **Kumar, Brajesh.** (2024). The prospects of pulsating stars studies with the International Liquid Mirror Telescope. *Bull. Soc. R. Sci. Liège, 93(2)* 855–862.

52. **Negi, Vibhore**, **Ailawadhi, Bhavya**, et al. (including **Dubey, Monalisa**, **Dukiya, Naveen**, **Kumar, Brajesh**, **Misra, Kuntal**, **Pranshu, Kumar**). (2024). Necessity of a TDI optical corrector for ILMT observations. *Bull. Soc. R. Sci. Liège 93(2),* 863–871.

53. **Misra, Kuntal**, **Aladwani, Bhavya**, et al. ( including **Dubey, Monalisa**, **Dukiya, Naveen**, **Kumar, Brajesh**, **Vibhore, Negi**, **Kumar, Pranshu**) .(2024). Accessibility of the ILMT Survey Data. *Bull. Soc. R. Sci. Liège. 93(2),* 872–879.

54. **Kumar, Brajesh**, **Bhavya, Ailawadni** et al. (including **Dubey, Monalisa**, **Dukiya, Naveen**, **Misra, Kuntal**, **Negi, Vibhore**, **Pranshu, Kumar)**. **(**2024). Follow-up strategy of ILMT discovered supernovae. *Bull. Soc. R. Sci. Liège*, 93(2),880–888.

55. **Dubey, Monalisa**, **Ailawadhi, Bhavya**, et al. (including **Misra, Kuntal**, **Dukiya, Naveen**, **Kumar, Brajesh**, **Negi, Vibhore**, **Kumar, Pranshu**). (2024). A year-long representation of the ILMT observations in different coordinate systems. *Bull. Soc. R. Sci. Liège,* 93(2), 889–894.

56. Surdej, Jean, **Ailawadhi, Bhavya**, **Dubey, Monalisa**, **Dukiya, Naveen** et al. (including, **Kumar, Brajesh**, **Misra, Kuntal**, **Negi,Vibhore**, **pranshu, Kumar**). (2024). The 4m International Liquid Mirror Telescope project. *Bull. Soc. R. Sci. Liège*, 93(2), 895–902.

57. Hickson, Paul, **Ailawadh, Bhavya**, et al. (including **Dubey, Monalisa**, **Dukiya, Naveen**, **Kumar, Brajesh**, **Misra, Kuntal**, **Vibhore, Negi**, **Kumar, Pranshu**). (2024). Serendipitous detection of Orbital Debris by the International Liquid Mirror Telescope: first results. *Bull. Soc. R. Sci. Liège, 93(2)*, 903–909.

58. Sun, Ethen, **AIlawadhI, Bhavya** et al. (including **Dubey, Monalisa**, **Dukiya, Naveen**, **Kumar, Brajesh**, **Misra, Kuntal**, **Negi,Vibhore**, **Kumar, Pranshu)**. (2024). SunPhot: preparations for an upcoming quasar variability survey with the International Liquid Mirror Telescope. *Bull. Soc. R. Sci. Liège, 93(2),* 910–917.

59. Fu, Jiuyang, **AIlawadhi, Bhavya** et al. (including **Dubey, Monalisa**, **Dukiya, Naveen**, **Kumar, Brajesh**, **Misra, Kuntal**, **Negi, Vibhore, Pranshu, Kumar).** (2024). Surface brightness properties of LSB galaxies with the International Liquid Mirror Telescope. *Bull. Soc. R. Sci. Liège*, 93(2), 918–923.

60. Baldeep, Grewal**, Ailawadhi, Bhavya** et al. (including **Dubey, Monalisa**, **Dukiya, Naveen**, **Misra, Kuntal**, **Kumar, Brajesh**, **Negi, Vibhore, Pranshu**, **Kumar**).(2024). Survey of variables with the ILMT. *Bull. Soc. R. Sci. Liège, 93(2),* 924–932.

61. Akhunov, Talat, **Ailawadhi, Bhavya**, et al. (including **Dubey, Monalisa**, **Dukiya, Naveen**, **Kumar, Brajesh**, **Misra, Kuntal**, **Negi, Vibhore**, **Kumar, Pranshu). (**2024). Observation of Multiply Imaged Quasars with the 4-m ILMT. *Bull. Soc. R. Sci. Liège, 93(2),* 933–940.

62. Surdej, Anna Pospieszalska, **Ailawadhi, Bhavya** et al. (including **Dubey, Monalisa**, **Dukiya, Naveen**, **Kumar, Brajesh**, **Misra, Kuntal**, **Negi, Vibhore**, **Pranshu, Kumar**). (2024). Detection and identification of asteroids with the 4-m ILM. *Bull. Soc. R. Sci. Liège* 93(2), 941–947.

63. **Sagar, Ram**. (2024). Indo-Belgian co-operation in astrophysics: from inception to future prospects. *Bull. Soc. R. Sci. Liège, 93(2),* 1029–1041.

64. Surdej,Jean, **Ailawadhi, Bhavya** et al. (including **Dubey, Monalisa**, **Dukiya, Naveen**, **Kumar, Brajesh**, **Misra, Kuntal**, **Negi, Vibhore**, **Pranshu, Kumar**). (2024). The 4 m International Liquid Mirror Telescope: A brief history and some preliminary scientific results. *Bull. Soc. R. Sci. 93(2),* 1054–1068.

65. **Bhattacharjee, Samaresh**, **Naja, Manish** & Rawat, Kishan Singh. (2024). ADPT: ARIES ST Radar data processing tool, *URSI-RCRS,* 1-5pp.

66. **Bhattacharjee, Samaresh**, **Naja, Manish.** (2025).Augmentation of TRM with upgraded high-power pulsed amplifier for Active Aperture Radar. Proc. 2025 4th International Conference on Range Technology (ICORT), 4pp.

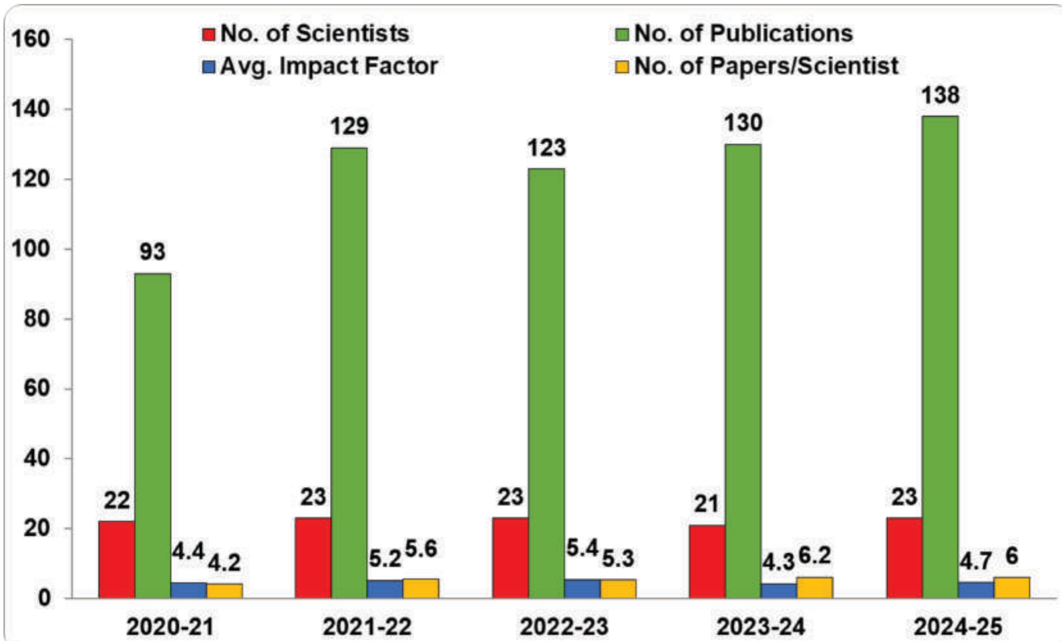



***Figure 53.*** *Publications in referred journals for the last 5 years.*

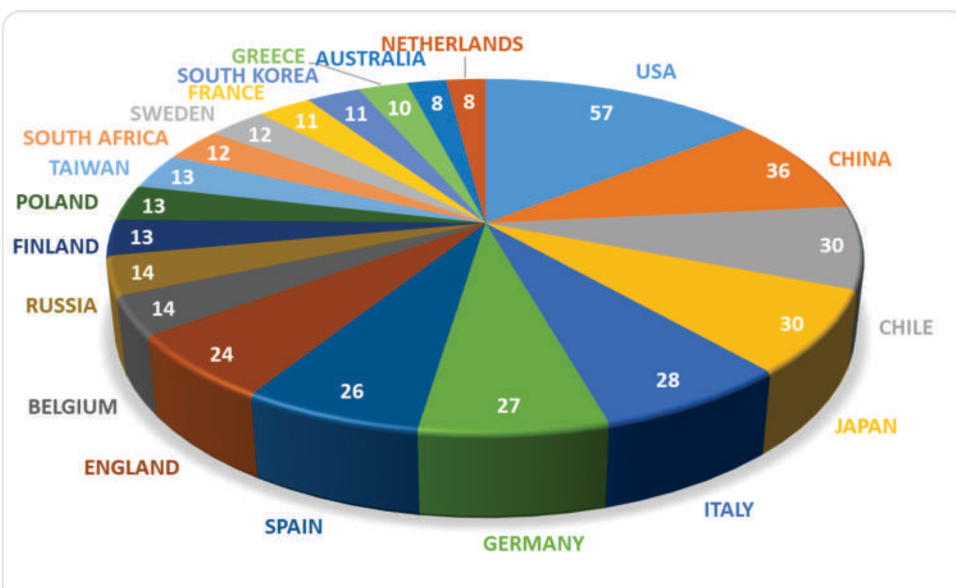



***Figure 54.*** *ARIES members have jointly co-authored publications with researchers affiliated to organisations in these countries (Only top 20 are shown).*

# Popular/Invited Talks by/Honours to ARIES Staff

## Brijesh Kumar

- *Understanding supernovae explosions*, 19 December, 2024, Introductory workshop on Astronomy and Astrophysics, Dolphin PG Institute of Biomedical and Natural sciences, Dehradun.

## Chandra Prakash

- *From Sun energy to solar power plant*, 18-23 November, 2024, AICTE Training and Learning (ATAL) Academy faculty development programme, Haldia Institute of Technology, Haldia.
- *Anthropogenic emissions influence the solar power generation*, 18-23 November, 2024, AICTE Training and learning (ATAL) Academy faculty development programme, Haldia Institute of Technology, Haldia.
- *How to access the satellite data*, 18-23 November, 2024, AICTE Training and learning (ATAL) Academy faculty development programme, Haldia Institute of Technology, Haldia.

## Govind Nandakumar

- *Detailed exploration of the near infrared spectra of M giant stars to chemically characterise the inner milky way*, 6 February, 2025, PRL, Ahmedabad.
- *Stars: the story tellers of our galaxy*, 4 March, 2025, National Science Day, ARIES.

## Indranil Chattopadhyay

- *Theoretical aspects of AGN,* 22 July, 2024, COBRA 2024, Presidency University, Kolkata.
- *Accretion processes/black hole astrophysics*, 9-10 August, 2024, Indian Institute of Technology (IIT) Kanpur.
- *Accretion processes/black hole astrophysics*, 20 November, 2024, ISSAC, St. Stephen's College.
- *Accretion onto compact objects*, 10 March, 2025, RETCO VI, IIT Indore.

## Jayshreekar Pant

- *3.6 मीटर देवस्थल एल्युमीनियम कोटिंग संयंत्र देवस्थल ऑप्टिकल दूरबीन के प्राथमिक दर्पण की कोटिंग प्रक्रिया,* 20-21 November, 2024, द्वितीय अखिल भारतीय वैज्ञानिक और तकनीकी राजभाषा संगोष्ठी, ARIES.
- *Introduction to astronomical telescopes and instruments*, 19 December, 2024, Introductory workshop on astronomy and astrophysics, Dolphin PG Institute of Biomedical and Natural Sciences, Dehradun.

## Jeewan Chandra Pandey

- *Exploring accretion flows in magnetic cataclysmic variables: insights from multiwavelength observations*, 26-28 August, 2024, 1$^{st}$ Indo-Thai symposium in astrophysics research and technology development, Chiang Mai, Thailand.
- *Capability of high-resolution spectrograph for 3.6-m Devasthal Optical Telescope*, 18-19 December, 2024, Asia Pacific astronomy sideways workshop, NCU, Taipei , Taiwan.

- *Astronomy at ARIES*, 26 February, 2025, ARIES-NAOJ Workshop, ARIES.
- *Magnetic cataclysmic variables: insights from multiwavelength observations*,11-12 March, 2025, First Indo-Japanese workshop on the extreme plasma phenomenon in the Universe, ARIES.
- *Stellar structure*, 22 April - 3 May, 2024, ARIES Training School in Observational Astronomy (ATSOA), ARIES.
- *Sun and Sun like stars*, 21-24 May, 2024, 7th Aditya Support Cell workshop, ARIES.
- *AstroSat: India's first space observatory*, 23 August, 2024, Public talk on national space day celebration, ARIES.
- *समय के साथ सूर्य*, 20-21 November, 2024, द्वितीय अखिल भारतीय वैज्ञानिक और तकनीकी संगोष्ठी, ARIES.
- *My research group activities*, 20-21 March, 2025, ARIES In-house Meeting (AIM), ARIES.
- *Eye, telescope and universe/दृष्टि, दूरबीन और ब्रह्मांड*, 22 March, 2025, ARIES Foundation Day, Nainital.
- *Exploring the secrets of universe from ARIES*, 28 February, 2025, National Science Day, ARIES.

## Kuntal Misra

- *Sky surveys in the optical wavelengths*, 4 July, 2024. National Initiative for Undergraduate Science (NIUS) camp, HBCSE, Mumbai.
- *Ground-Based Indian (optical) facilities*, 1-2 April, Transients 2024, IIT Bombay, Mumbai.
- *The 4m International Liquid Mirror Telescope*, 22 April-3 May, 2024, ATSOA, ARIES.
- *Testing gravity with multi-messenger astronomy*, 22-24 July, 2024, IIT Bombay, Mumbai.
- *India: latest developments in astronomy and future plans*, 9-13 September, 2024, the 10th BRICS astronomy workshop and working group (BAWG 2024) meeting, Fazan Federal University, Kazan, Russian Federation, Survey science and big data ( Represented India as the National Co-ordinator).
- *An Overview of the 4m International Liquid Mirror Telescope*, 20 September, 2024, State of the Universe (SOTU), Friday seminar series of the Cosmology and Astroparticle Physics Group, TIFR, Mumbai.
- *An overview of the 4m International Liquid Mirror Telescope*, 28 November, 2024, Department of Physics, IIT Hyderabad.
- *An overview of the 4m International Liquid Mirror Telescope*, 29 November, 2024, Department of Physics, Birla Institute of Technology and Sciences (BITS) Hyderabad.
- *An overview of the 4m International Liquid Mirror Telescope*, 4 February, 2025, Department of Astrophysics, Geophysics and Oceanography, Liege University, Belgium.
- *Very high energy emission in gamma ray bursts*, 11-12 March, 2025, Indo-Japanese workshop on extreme plasma phenomena in the universe, ARIES.

## Manish Kumar Naja

- *Air pollution & climate change studies at ARIES*, 16 April, 2024, online meeting, IIT Jodhpur.
- *Variability in the tropospheric ozone in Asian Summer Monsoon region: Ozonesonde observations (2011-2023)*

*from ARIES, Nainital*, 2-7 June, 2024, STIPMEX, IITM, Pune.

- *Report presentation during 1st Coordination Meeting on the 61st IPCC session on Scoping Meeting on the methodology report on short-lived climate forces (SLCF)*, 24 June, 2024, Brisbane, Australia.

- *Long-term and campaign-based measurements of volatile organic compounds in the Himalayas and northwest India*, 28-30 August, 2024, Aakash International Workshop, RIHN, Kyoto, Japan.

- *Air pollution and climate change, Refresher course on physics – frontier in physical sciences,* 11-14 December, 2024, UGC-Malviya Mission Teachers Training Centre, Department of Physics, DDU Gorakhpur University, Gorakhpur.

- *Greenhouse gases and Earth observing system, Refresher course on physics – frontier in physical sciences*, 11-14 December, 2024, UGC-Malviya Mission Teachers Training Centre, Department of Physics, DDU Gorakhpur University, Gorakhpur.

- Guest speaker, 25 February, 2025, Topper's conclave 2025, Kumaun University, Nainital.


***Figure 55.*** *Dr. Manish K. Naja, Director, ARIES, Prof. Satpal S. Bisht, Vice Chancellor, SSJ University, Almora and Prof. Diwan S. Rawat, Vice Chancellor, Kumaun University, Nainital lighting the lamp during the Topper's Conclave 2025.*

- Member, Government of India delegation to the Intergovernmental Panel on Climate Change (IPCC) scoping meeting, Brisbane, Australia, 26-28 February 2024.

- *Research activities and opportunities at ARIES*, 6-7 March, 2025, 9th International conference on recent advances in science, Invertis University, Bareilly.

- *Trace gases, aerosols and dynamical studies over Himalayas and related regions*, 20-21 March, 2025, AIM, ARIES.

- *Closing the early warning gap together*, 24 March, 2025, World Meteorological Day, NPL, New Delhi.

## Mohit Kumar Joshi

- *The Road to Viksit Bharat: Space Technology for National Development*, 23 August, 2024, National Space Day, SSJ University, Almora.

- Aryabhatta Award, 20 October, 2024, Saptarshi Puraskar Shrunkhala 2024, Hindu Research Foundation, Nagpur.

- *Indigenious and traditional knowledge system*, 8 February, 2025, Uttarakhand State Science & technology Congress, UCOST, Dehardun.


***Figure 56.*** *Mr. Mohit Kumar Joshi receiving the Aryabhatta award at Saptarshi Puraskar Shrunkhala 2024.*

## Narendra Singh

- *Himalaya, air pollution and disasters*, 9 September, 2024, Colloquium on disaster management and mitigation strategies (HIMALAYA DIWAS SAMAGAM-2024), Dolphin PG Institute of Biomedical and Natural Science, Dehradun.

- *Dust storms and their impact on Himalayas*, 23-24 September, 2024, 10$^{th}$ International meeting of WMO SDS-WAS Regional Steering Group (R&G) & Workshop on Dust and Aerosols, Ministry of Earth Sciences, Delhi.

- *Are we polluting air? Himalaya an indicator of climate change*, 8-13 October, 2024, National workshop on experimental physics based on local resources, DIET Bageshwar.

- *Climate change in the Himalayas and extreme weather events*, 15 October, 2024, Refresher course on climate change and disaster management (Interdisciplinary), Indira Gandhi National Tribal University (IGNTU), Amarkantak.

- *Air pollution, climate change and calamities: the Himalayan perspective*, 26 November, 2024, Faculty induction programme (Guru Dakshata), Malaviya Mission Teacher Training Centre (MMTTC), Indira Gandhi National Tribal University (IGNTU), Amarkantak.

- *Concerns of Himalayan environment: an observational perspective*, 21 February, 2025, National workshop on relevance of Ancient Indian Knowledge Systems in the present scenario, Lal Bahadur Shastri Govt. PG College, Halduchur, Nainital.
- *Climate change in Uttarakhand: A Himalayan perspective,* 27-28 February, 2024*,* Empowering Indian youth for global leadership in science and innovation for Viksit Bharat, UCOST, Dehradun.

## Priyanka Srivastava

- *Linkage between aerosol loading and lightning occurrences*, Workshop on atmospheric lightning monitoring, forecasting and mitigation, 28-29 November, 2024, NRSC, Hyderabad.

## Santosh Joshi

- *Studies of stellar variability*, 26 April, 2024, ATSOA, ARIES.
- *Asteroseismology of CP stars using photometric and spectroscopic technique*, 20-21 March, 2025, AIM, ARIES.
- *Updates on 104-cm Sampurnanand Telescope*, 21 March, 2025, AIM, ARIES.

## Samaresh Bhattacharjee

- *हिमालयी वायुमंडल का अनावरणः एरीज एसटी रडार*, 20-21 November, 2024, द्वितीय अखिल भारतीय वैज्ञानिक और तकनीकी राजभाषा संगोष्ठी, ARIES.

## Saurabh

- *Optical-NIR detectors in astronomy*, 22 April - 3 May, 2024, ATSOA, ARIES.
- *Star formation and stellar evolution*, 20-21 March, 2025, AIM, ARIES.
- *Status report on 3.6m DOT*, 20-21 March, 2025, AIM, ARIES.

## S. Krishna Prasad

- *Compressive oscillations in flare-associated coronal loops*, 19 July, 2024, UK national astronomy meeting, University of Hull, UK.
- *Compressive oscillations in flare-associated coronal loops*, 6 September, 2024, Northumbria University, UK.
- *The propagation and damping of slow magnetoacoustic waves in a multi-thermal coronal loop*, 11 November, 2024, Asia Pacific solar physics meeting (ASPSM) 6, Guangzhou, China.
- *The properties of propagating compressive waves in a multi-thermal coronal loop*, 21 January, 2025, Sun, space weather and solar- stellar connections meeting, Indian Institute of Astrophysics (IIA), Bengaluru.
- *The origin, proportion, and dissipation of slow magnetoacoustics waves in the solar atmosphere*, 17 March, 2025, Solar orbiter remote sensing working group meeting on atmospheric heating.
- *The Sun and Aditya L-1*, 16 August, 2024, National Space Day, MB Govt. PG College, Haldwani.

### Suvendu Rakshit

- *An introduction to cosmology*, 22 April - 3 May, 2024, ATSOA, ARIES.
- *The Monster in the heart: the sub-pc region of AGN*, 26 December, 2024, IUCAA, Pune.
- *Unveiling the wonders of the universe*, 18 February, 2025, Invertis University, Bareilly.

### Tarun Bangia

- *एरीज के खगोलीय प्रेक्षणों में यांत्रिक अभियांत्रिकी का योगदान*, 20-21 November, 2024, द्वितीय अखिल भारतीय वैज्ञानिक और तकनीकी राजभाषा संगोष्ठी, ARIES.

### Vaibhav Pant

- *Kinematics and thermodynamic properties of CMEs in the inner corona*. 10-15 November, 2024, ASPSM 2024, Guangzhou, China.
- *Decayless waves in the solar atmosphere*, 7-8 November, 2024, International Space Science Institute (ISSI), Beijing, China.
- *Transverse oscillations in the solar atmosphere*, 13-21 July, 2024, COSPAR, Busan, South Korea.
- *Coronagraph observations using a compact coronagraph*, 17 April, 2024, U. R. Rao Satellite Centre (URSC), Bangalore.

### Virendra Yadav

- *Taking astronomy to the general public*, 25 April, 2024, ATSOA, ARIES.
- Tutorials and grading duty, 2-10 May, 2024, Astronomy orientation cum selection camp, HBCSE, Mumbai.
- *Basics of stargazing*, 20 May, 2024, YUVIKA, IIRS, Dehradun.
- *खगोल विज्ञान और अंतरिक्ष अन्वेषण का महत्व*, 14 August, 2024, National Space Day, Devasthal Observatory, ARIES.
- *Space telescopes - eyes in the sky*, 20 August, 2024, National Space Day, Shemford School, Haldwani.
- *Why should we study astronomy*, 21 August, 2024, National Space Day, Aryaman Vikram Birla Institute of Learning, Haldwani.
- *Why do we study astronomy*, 13 September, 2024, National Space Day, Air Force Station, Bhowali, Nainital.
- *Career counselling and guidance*, 8 February, 2025, GIC Jangliyagaon, Bhimtal.
- *Let's see the planetary parade*, 12 February, 2025, MB Govt. PG College, Haldwani.
- *Let's explore the Sun*, 15 February, 2025, Public outreach during ASI annual meeting, Kendriya Vidyalaya, National Institute of Technology Rourkela
- *Reasons behind seasons*, 28 February, 2025, National Science Day, ARIES.
- *Knowledge resource centre (KRC) and ARIES science popularisation & outreach programme (ASPOP)*, 21 March, 2025, AIM, ARIES.

### Yogesh Chandra Joshi

- *Quest for new habitable worlds*, 24 April, 2024, Institute of Advanced Study in Science and Technology (IASST), Guwahati.
- *Exploring open clusters to unravel galactic structure*, 15-19 February, 2025, 43rd annual meeting of the Astronomical Society of India, NIT Rourkela.

## Contributory Talks by ARIES Staff

### Brijesh Kumar

- *An overview of optical astronomy*, 22 April - 3 May, 2024, ATSOA, ARIES.
- *Writing successful observing proposals - expectations from TAC users workshop on writing observing proposals for 3.6m DOT*, 29 July, 2024, ARIES.
- *Ethics, governance and sustainability capacity building workshop on vigilance awareness*, 28 October, 2024, ARIES.

### Chandra Prakash

- *Application of LiDAR in atmospheric research: cloud detection in the foothills of Himalaya*, 17-20 December, 2024, IASTA-2024, Doon University, Dehradun. *(LOC member of the conference)*
- *वायुमंडलीय अनुसंधान में लिडार के अनुप्रयोग*, 10 January, 2025, Vishwa Hindi Divas, ARIES.

### Kuntal Misra

- *Understanding the GRB classification conundrum*, 9-13 September 2024, The 10th meeting of the BRICS working group on astronomy (BAWG 2024), Kazen Federal University, Kazan, Russian Federation.
- *Initial results from the 4m International Liquid Mirror Telescope (ILMT)*, 15-19 February, 2025, ASI 2025, NIT Rourkela.
- *Time domain astronomy, The 4m International Liquid Mirror Telescope (ILMT)*, 20-21 March, 2025, AIM, ARIES.

### Manish Kumar Naja

- *Aerosols Studies over Mountainous Regions*, 27-28 June 2024, IGBP (ARFI & NOBLE) Workshop, SPL, Trivandrum.

### Neelam Panwar

- *Influence of radiative feedback in star-forming regions*, 26 August, 2024, 1st Indo-Thai symposium on astrophysics research and technology development.
- *A stellar journey: from gas clouds to fiery balls*, 19 December, 2024, Department of Physics, DINBS, Dehradun.
- *Multiwavelength astronomy: A comprehensive view*, 20 December, 2024, Department of Physics, DINBS Dehradun.

## Priyanka Srivastava

- *Science of atmospheric aerosols: tiny particles big impacts*, 22 April - 3 May, 2024, ARIES Training school in observational astronomy (ATSOA), ARIES, Nainital.
- *Constraining GHG emissions across the japan east coast using satellites, Models and first continuous year-round ship-based measurements*, 22-25 October, 2024, 6th URSI-RCRS 2024, Bhimtal, India.
- *Insights from about two decades of ground and space-based aerosol observations over the central Himalayas*, 22-25 October, 2024, 6th URSI-RCRS 2024, Bhimtal, India.
- *Novel approach characterising pollutant sources using online aerosol measurements over a high-altitude site in central Himalayas*, 17-20 December, 2024, IASTA national conference 2024, Doon University, Dehradun.
- *Aerosols and trace gases*, 20-21 March, 2025, ARIES In-house Meeting (AIM).

## Samaresh Bhattacharjee

- *ADPT: ARIES ST radar data processing tool*, 22-25 October, 2024, 6th URSI-RCRS 2024, Bhimtal, India.
- *Characteristics of atmospheric boundary layer studied using 206.5 MHz ST radar over the central Himalayas: preliminary results*, 22-25 October, 2024, 6th URSI-RCRS 2024, Bhimtal, India. *(poster)*
- *Augmentation of TRM with upgraded high-power pulsed amplifiers for active aperture radar*, March 2025, ICORT 2025.

## Saurabh

- *Near-infrared instruments at 3.6m DOT*, 26-28 August, 2024, Chiang mai, Thailand.
- *Role of filamentary clouds in star formation*, 21 November,2024, National Hindi Conference.
- *ARIES 3.6m telescope and its near-infrared instruments*, 18-19 December, 2024 Institute of Astronomy, NCU, Taiwan.
- *ARIES observational facilities*, 26 February 2025, ARIES-NAOJ workshop, ARIES.
- *Governing council (GC) presentation on 3.6 m DOT and related instruments*, 25 September 2024, ARIES.
- *Session on DOT observing proposal (TANSPEC and TIRCAM2)*, 29 July 2024 ARIES. Nainital.
- *DOMU presentation on 3.6 m DOT meeting*, 19-20 October, 2024, ARIES.

## Suvendu Rakshit

- *Extra-galactic astronomy: AGNs*, 20-21 March, 2025, ARIES In-house Meeting (AIM).

## Tarun Bangia

- *Development and prototype testing of a monitoring system for 3.6m DOT equipment*, 15- 19 February, 2025, The 43rd meeting of the Astronomical Society of India (ASI 2025), NIT Rourkela, India.
- *Engineering with respect to space science observation*, 28 February, 2025, GEHU, Bhimtal.

## Yogesh Chandra Joshi

- *Investigating transiting exoplanets: insights from observational studies*, 09 January, 2025 ISRO, Bengaluru.
- *Investigating transiting exoplanets: insights from observational studies*, 14 February, 2024, Goa.
- *Investigation of open clusters to probe the galactic structure*, 26-28 August 2024, 1st Indo-Thai symposium on astrophysics research and technology development (ITSAT 2024) NARIT, Thailand.

# Invited Talks at ARIES by Members from Other Organisations

**Dr. Kaustubh Hakim**, Royal Observatory of Belgium, *Chemical diversity in rocky exoplanets and sub-neptunes from laboratory and AB initio Simulations*, 23 April, 2024.

**Dr. Sydney A. Barnes**, AIP, Potsdam, *Gyrochronology: a route to the ages of cool field dwarfs*, 26 April, 2024.

**Dr. Satish Kumar Dubey**, IIT Delhi, *AI-enabled field portable lensless microscopy for detection of filariasis*, 04 June, 2024.

**Dr. Anu Kundu**, CSR, North-West University (NWU), Potchefstroom, *Multipolar magnetic field of millisecond pulsars*, 11 June, 2024.

**Dr. Govind Nandakumar**, Lund University, Sweden, *Exploring the near infrared spectra to chemically characterise the inner milky way*, 09 July, 2024.

**Dr. Subhajeet Karmakar**, NASA-GSFC, *Are we looking at the correct habitable worlds?*, 20 August, 2024.

**Dr. Ashwani Pandey**, Institute of High Energy Physics, CAS, *New theoretical Fe II templates for bright quasars*, 3 September, 2024.

**Prof. Manoj Puravankara**, TIFR, Mumbai, *A pint of IPA & HEFE: peering into newborn stars with JWST*, 19 September, 2024.

**Dr. S. K. Varshney**, DST, New Delhi, *Approaches to international scientific cooperation*, 27 September, 2024.

**Dr Rahul Gupta**, NASA-GSFC, Gamma-Ray Bursts: unveiling the universe's most powerful explosions, 22 October, 2024.

**Dr. Dipen Sahu**, PRL, Ahmedabad, From molecular core to star and planet formations, and our astrochemical origin, 25 October, 2024.

**Dr. Hareesh Gautham Bhaskar**, Technion-Israel Institute of Technology, Haifa, *Resonant and secular evolution of three body systems – with applications to planetary systems and gravitational wave sources*, 12 November, 2024.

**Dr. Richard French**, Space science institute in Boulder, Colorado (USA), *The Cassini mission to Saturn: An insider's view of an international journey of discovery*, 13 November, 2024.

**Prof. Jean Surdej**, University of Liège, Belgium, *Observing the wonders of nature - From camera obscura to* *the International Liquid Mirror Telescope 4m (ILMT)*, 19 November, 2024.

**Prof. Jean Surdej**, University of Liège, Belgium, *The optical gravitational lens experiment and discovery of multiply imaged quasars with Gaia and the ILMT*, 22 November, 2024.

**Dr. Kishalay De**, MIT, USA, *From dust to dust: Using infrared surveys to reveal the explosive life cycles of stars and their remnants*, 26 November , 2024.

**Prof. Deepak Dhingra**, IIT Kanpur and **Prof. Christian Wohler**, Dortmund University of Technology, *Observing the moon: landscape, composition and surface texture*, 18 November, 2024.

**Dr. Mayukh Pahari**, IIT Hyderabad, Chandra non-nuclear source characterisation: a multiwavelength point-source survey in nearby galaxy fields, 10 December, 2024.

**Dr. Jyotirmay Paul**, University of Exeter, UK, *Rejuvenating the optical observational facility for deeper sky exploration*, 02 December , 2024.

**Dr. Ankur Ghosh**, CAPP, University of Johannesburg, South Africa, *Dissecting the radiative puzzle of VHE GRBs: insights from multi-wavelength modeling*, 23 December, 2024.

**Dr. Rajesh Kumar**, NSF National Center for Atmospheric Research, Boulder, USA, *Advancing air quality predictions: challenges, innovations, and future opportunities*, 24 December, 2024.

**Mr. A. H. Sheikh**, Department of Physics, Gauhati University, Guwahati, *Probing star formation and stellar evolution: multiwavelength and statistical insights into open star clusters and blue straggler stars*, 2 January, 2025.

**Dr. Parul**, Blue Skies Space Ltd., London, *Mauve: A UV-Vis satellite dedicated to monitor stellar activity and variability*, 28 January, 2025.

**Dr. Surendra K Dhaka**, Rajdhani College, University of Delhi, Delhi, *Variability and trends in the particulate matters in Delhi NCR throughout the last one and half decade*, 27 January, 2025.

**Dr. Prajjwal Rawat**, NASA Langley Research Center, USA, *Advancing air quality research with geostationary satellites and aircraft observations*, 30 January, 2025.

**Dr. Somnath Bar**, University of California, Irvine, USA, *Indian forest fire dynamics and potential scope of fuel management*, 27 February, 2025.

**Dr. Mizuo Kajino**, Meteorological Research Institute (MRI), Japan, *Impact of post monsoon crop residue burning on PM2.5 over North India: optimizing emissions using a high-density in situ surface observation network*, 28 February, 2025.

**Prof. Saumitra Mukherjee**, New Environment and Energy Research, Greater Noida, *Extra terrestrial influence on environment of the Earth*, 13 March , 2025.

**Dr. Mahavir Sharma**, IIT Bhilai, *Reionization and galaxy formation post-JWST*, 13 March , 2025.

**Dr. Mridweeka Singh**, IIA, Bengaluru, *Insights into the distinctive features of type tax supernovae*, 18 March , 2025.

# International and National Research Projects

**Name of Project:** Constraining the Nature of Multi-messenger Transients with Coordinated Multi-wavelength Observations (CoNMuTraMO)
**PI (ARIES):** Kuntal Misra
**Funding Agency:** DST-BRICS
**Project Code:** DST/ICD/BRICS/Call-5/CoNMuTraMO/2023 (G)

**Name of Project:** Belgo-Indian Network for Astronomy and Astrophysics (BINA)-2
**PI (ARIES):** Santosh Joshi
**PI of the Collaborating Institute:** Peter De Cat, ROB, Belgium
**Funding Agency:** DST, Govt. of India
**Project Code:** DST/INT/BELG/P-09/2017

**Name of project:** An interdisciplinary study toward clean air, public health and sustainable agriculture: the case of crop residue burning in North India.
**PI (ARIES):** Narendra Singh
**Funding Agency:** RIHN (Research Institute for Humanity and Nature), Japan

**Name of project:** Indo-Uzbek Proposal: Search for variable stars in open star cluster.
**PI (ARIES):** Ramakant S. Yadav
**PI of the collaborating institute:** Alisher Hojaev, Ulugh Beg Astronomical Institute, Uzbekistan Academy of Sciences, Tashkent.
**Funding Agency:** DST, Govt. of India
**Project code:** INT/Uzbek/P-19

**Name of Project:** Search and Follow-up Studies of Time-domain Astronomical Sources using Sky Surveys, BRICS Telescopes, and Artificial Intelligence
**PI (ARIES):** Santosh Joshi
**PI of the Collaborating Institute:** Oleg Malkov INASAN, Moscow, Kefeng Tan, NAOC, China
**Funding Agency:** DST, Govt. of India
**Project Code:** DST/ICD/BRICS/Call-5/SAPTARISI/2023(G)

**Name of Project:** Gravitational Lensing and Supernovae studies of the distant Universe using ARIES telescopes
**Co-P.I. (ARIES):** Kuntal Misra
**P. I. of the Collaborating Institute:** Jean Surdej, University of Liege, Belgium
**Funding Agency:** ANRF
**Project Code:** VJR/2021/000030

**Name of Project:** Investigation of co-existance of slow and transverse waves in polar plumes
**P. I. (ARIES):** Vaibhav Pant
**Funding Agency:** Royal Observatory of Belgium

**Name of Project:** Probing wave energy transport in the solar atmosphere (PROTSAhan)
**PI (ARIES):** Vaibhav Pant
**Funding Agency:** SERB (DST), Govt. of India
**Project Code:** SRG/2022/001687

**Name of Project:** Probing Influence of radiative feedback in massive star-forming complexes
**PI (ARIES):** Neelam Panwar

**Funding Agency:** SERB (DST), Govt. of India
**Project Code:** CRG/2021/005876

**Name of Project:** Study of Stability and Outburst in Luminous Blue Variables (LBV)
**PI of the Collaborating Institute:** Abhay Pratap Yadav, NIT, Rourkela
**Co-PI (ARIES):** Santosh Joshi and Yogesh C. Joshi
**Funding Agency:** SERB (DST), Govt. of India
**Project Code:** CRG/2021/007772-G

**Name of Project:** Supermassive black holes in AGN through spectro-polarimetry at 3.6m DOT using in-country developed spectrograph and camera
**P. I. (ARIES):** Suvendu Rakshit
**Funding Agency:** SERB (DST), Govt. of India
**Project Code:** SRG/2021/001334

**Name of Project:** Wave dissipation in the magnetised solar atmosphere: Implications on heating and seismology
**P. I. (ARIES):** S. Krishna Prasad
**Funding Agency:** SERB (DST), Govt. of India
**Project Code:** SRG/2023/002623

**Name of Project:** What makes radio bright Gamma Ray Bursts special?
**Co-PI (ARIES):** Kuntal Misra
**P.I. of the Collaborating Institute:** L. Resmi, IIST, Thiruvanthapuram
**Funding Agency:** ANRF
**Project Code:** CRG/2022/008253

**Name of Project:** Exploration of solar coronal jets and associated small-scale flaring processes during solar cycle 24 and 25.
**P. I. (ARIES):** Vaibhav Pant
**Funding Agency:** ISRO-RESPOND
**Project Code:** ISRO/RES/2/441/23-24

**Name of Project:** Probing origins of the Solar Wind (SOLWIND)
**P. I. (ARIES):** Vaibhav Pant
**P. I. of the Collaborating Institute:** Laxmi Pradeep Chitta, Max Plank Institute of Solar System Research, Germany
**Funding Agency:** DST-DAAD
**Project Code:** DST/INT/DAAD/P-13/2023

**Name of project:** Observations of trace gases at a high altitude site in the Central Himalayas.
**PI (ARIES):** Manish Naja
**Funding Agency:** ISRO-ATCTM, India.

**Name of project:** Study of the aerosol characteristics over central Himalayas.
**PI (ARIES):** Manish Naja
**Funding Agency:** ISRO-ARFI, India.

**Name of project:** Atmospheric Boundary Layer Network & Characterization: Network of Observatories for Boundary Layer Experiments (ABLN&C: NOBLE).
**PI (ARIES):** Narendra Singh
**Funding Agency:** ISRO, VSSC Trivandrum

# 3.6m DOT

## 1. Observation Statistics from 3.6m DOT

### 1.1 Proposals

**2024-C2:** For this observation cycle, a total of 41 proposals were received, of which 28 were ARIES, 12 were Indian, and 1 was in the Belgian category. A total of 30 proposals were allocated observation time by DTAC.

**2025-C1:** 52 proposals were received in this cycle, in which 31 were ARIES, 18 were Indian, and 3 were Belgian. DTAC allocated observation time to 42 proposals out of the 52.

### 1.2 Observations

The performance of the 3.6m DOT during the observation cycles - 2024-C2 and 2025-C1 is illustrated in the Figure. These pie-charts represent the total number of hours utilised for scientific observations and the time lost due to bad weather or technical issues. The data span the period from 1 October, 2024 to 10 March, 2025.

In 2024-C2, out of the total available time, 711.7 hours (68.3%) were successfully utilised for observations. The remaining time was lost due to bad weather (27.7%), technical issues (2.1%), and unclaimed ToO (1.9%).

In contrast, during 2025-C1, the used observation time was lower at 393 hours (39.6%). The loss was mainly due to bad weather (48.5%). Some loss was also due to technical issues (10.4%), and unclaimed ToO (1.4%).

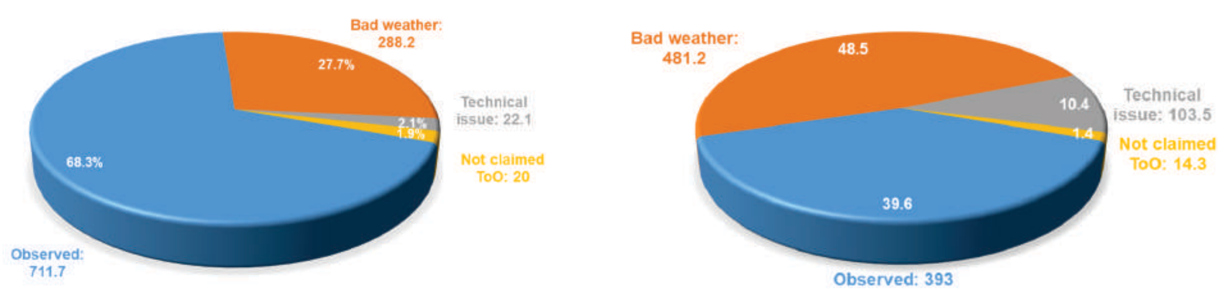



*Figure 57. Pie charts displaying the total time (number of hours) observed and lost due to bad weather and technical issues for observing cycle (Left) 2024-C2 and (Right) 2025-C1.*

### 1.3 Service mode Observations

The 3.6m DOT team successfully initiated service mode observations for PIs from institutions other than ARIES during 1 October, 2024 - 31 May, 2025. 2 and 23 service mode observations were conducted in 2024-C2 and 2025-C1 respectively. These observations were requested by researchers from several institutes, including PRL (Ahmedabad), IIA (Bangaluru), IIT (Kanpur), and TIFR (Mumbai). The proposals required domain-specific expertise and covered a wide range of scientific targets, including stellar observations, spectroscopy of asteroids, and studies of galaxies. Despite the loss of a few sessions due to adverse weather, the majority of the observations were successfully executed, marking a significant step forward in providing service mode observations using the 3.6m DOT.

## 2. New 3.6m DOT website

A dedicated standalone website was developed for the 3.6m DOT, marking a significant upgrade from the earlier web page. The new platform offers comprehensive information about the telescope, including detailed specifications of the telescope system.

Each back-end instrument has its own dedicated page, which was thoughtfully designed to be observer-friendly. All key parameters relevant to observations are clearly presented in a single view, enabling observers to efficiently plan their proposals and observation strategies. Standard Operating Procedures (SOPs) for all instruments were prepared in a unified, accessible format and are available on the respective pages. The SOPs for mounting and unmounting procedures of the instruments are also available on the new website.

The website was integrated with the new DOPSES proposal submission system, streamlining the access for observers to submit their proposals. Additionally, a newly developed web interface for the 3.6m DOT's live weather station was linked to the website. This feature allows users to monitor real-time as well as historical


***Figure 58.*** *The new website for the 3.6m DOT.*

weather conditions at Devasthal—an essential tool for remote observers relying on service mode observations.

The website also provides a gallery of images taken from different instruments mounted on the 3.6m DOT, showing its imaging capabilities to the general public. This page also includes several other categories of pictures related to the 3.6m DOT and the Devasthal site. The website also includes the internal DOT archive.

For visiting observers, the website includes a detailed "How to Reach" guide along with comprehensive contact information to facilitate planning and coordination. The screenshots of a couple of webpages of the website are shown in **figure 58**.

## 3. The Auto-Guiding Unit of the 3.6m DOT

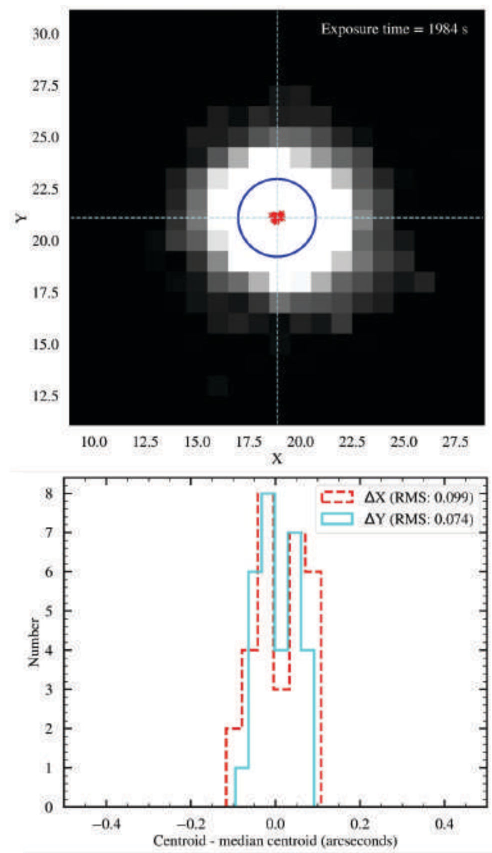



***Figure 59.*** *Top: The target star observed in closed-loop guiding for 1984 seconds in kinetic mode. The blue circle marks the point spread function (PSF) size, with centroid positions overlaid as red crosses. Bottom: Histogram of the target star's centroid shifts. The AGU maintained the centroid within 0.4".*

The Auto-Guiding Unit (AGU) of the telescope using an old camera was implemented successfully for observations. Several tests were conducted to tune it according to each backend instrument for this implementation. The main problems restricting the use of AGU were identified and sorted out. A detailed, user-friendly SOP to operate the AGU was developed. It has been used for science observations since January, 2025. The AGU has improved the data quality, especially in the spectroscopic observations. The performance of the

AGU in both imaging and spectroscopy modes is shown in **figures** 59 **& 60**.

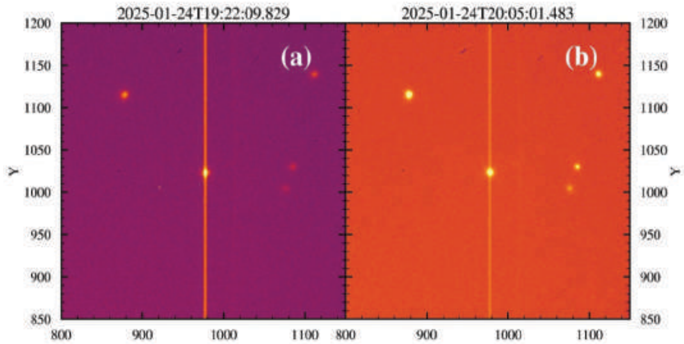



***Figure 60.*** *(a) Target star on the slit before the spectroscopic exposure. (b) Star's position after a 43-minute exposure.*

### 3.1 Generic Guider Camera Software module

There were issues with the shutter and cooling system of the old camera. It was planned to install a new camera in the guiding unit of the 3.6m DOT. The electrical, mechanical, and optical integration of a new Andor guider camera with the 3.6m DOT was completed. The complete operational integration is in process with software support from the AMOS team.

## 4. Auxiliary software development for DOT

Software tools were required to support observations and telescope operations. For this several GUI-based applications were created and provided to the observers and scientific assistants to facilitate their work during observations. These include:

- A GUI for locating guide stars to be used with the Auto Guiding Unit (AGU) for any observation field.
- Offset calculators for all instruments to apply precise telescope offsets.
- Updated SPIM filter wheel software for selection of filters as well as logging key parameters.
- Weather station software featuring colour-coded alerts to indicate warnings on humidity, dew point, and a live wind speed display.
- An interactive tool for estimating FWHM from FITS files, which aids in telescope focusing.
- An upgraded version of DOPSES, the proposal management system for DOT.

### 4.1 Guide Star Finder

With the improved functionality of the AGU unit, a standalone software tool was developed to identify suitable guide stars for any target pointed by the telescope. This software automatically retrieves the RA and DEC of the current target from the Telescope Control System (TCS) and searches for nearby bright stars within a configurable radius, depending on the field of view (FoV) of the instrument in use. It accesses both VizieR and Gaia catalogues to identify potential guide stars. The resulting list is sorted based on V-band or G-band magnitude and includes each star's RA, DEC, and angular distance from the target. The software has been deployed and is actively used by the scientific assistants to support AGU operations.

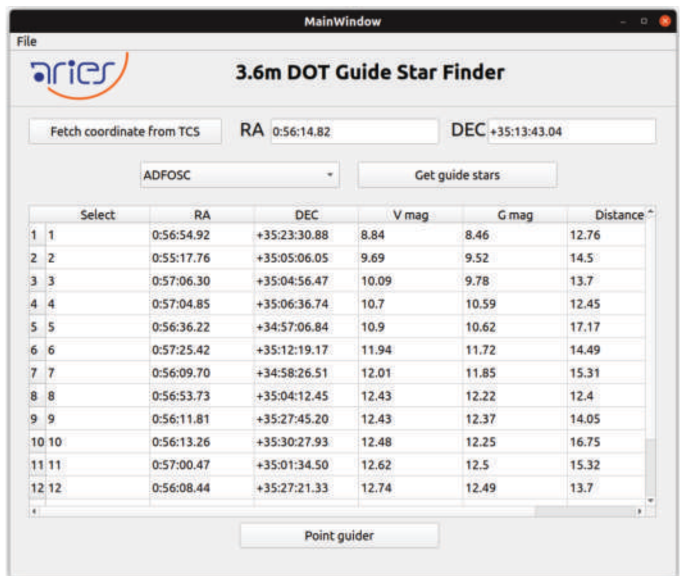



***Figure 61.*** ***A*** *new GUI to find the possible guide stars around the observed target.*

### 4.2 Offset calculators for ADFOSC and TANSPEC

Precise placement of targets in the slits of ADFOSC and TANSPEC, regardless of the target's orientation in the sky, requires accurate offset calculators. These tools were designed to estimate and apply the necessary offsets to the telescope. A unified interface for the DOT offset calculator, supporting all four instruments currently in use, was developed. The software was deployed and is operating in version 4.0, with further updates planned. It calculates offsets for rotated slit positions based on the Position Angle of the source with a good accuracy. It also allows the user to change the optical centre of the instrument through a parameter file.

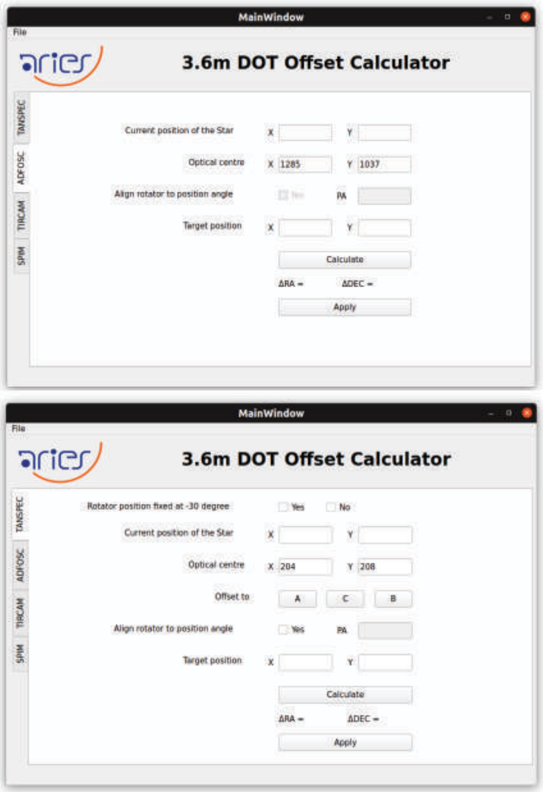



***Figure 62.*** *Unified interface for the offset calculator developed for the instruments on the 3.6m DOT.*

## 4.3 SPIM Filter wheel selection and data logging software

The SPIM filter wheel software, developed using the VB.NET framework, was modified to enable logging of 15 parameters from the TCS and weather station both. These logged parameters are intended for use by the archiving team to update the headers of the raw observational data from SPIM. This is currently being deployed for SPIM observations.


***Figure 63.*** *The modified filter wheel selection and parameter logging software for SPIM.*

## 4.4 New weather station interface for DOT

A weather display interface, available both online and offline, was developed to present real-time weather conditions critical for astronomical observations. The software retrieves live data from the DOT weather station server and displays key parameters such as wind speed, wind direction, humidity, temperature, and atmospheric pressure. To enhance user awareness, the interface includes a colour-coded warning system to highlight adverse conditions. It also features an integrated view from the DOT all-sky camera, providing a continuous visual of the sky. Designed to assist observers in making informed decisions, the software remains under active development and is planned for integration with the DOT website to ensure broader accessibility and streamlined operation.

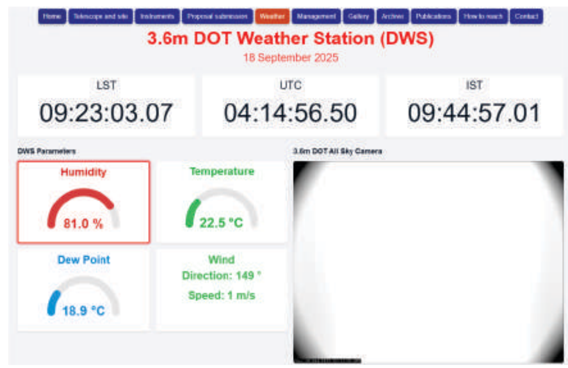



***Figure 64.*** *The online interface of the new Weather Station for DOT. The camera view is from the DOT all-sky camera.*

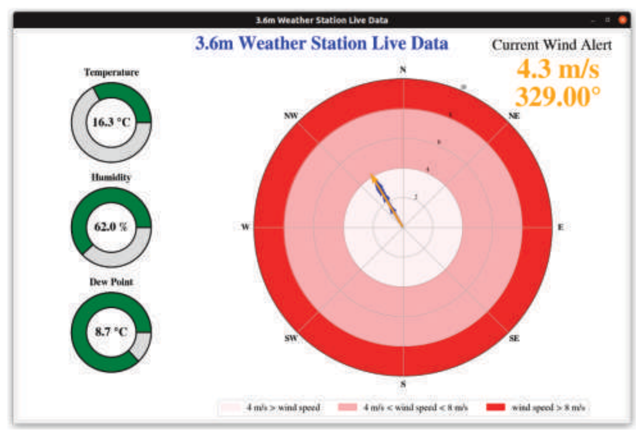



***Figure 65.*** *The offline interface of the new Weather Station for DOT. The live wind speed and direction are depicted in the polar plot.*

## 4.5 Interactive interface for FWHM estimation

Focusing the telescope is a critical step performed at the beginning of each observing session. Previously, estimating the Full Width at Half Maximum (FWHM) was a time-consuming task, as the scientific assistants had to rely on DS9 software for manual measurements. To streamline it, a new interactive tool user-friendly interface was implemented on the ADFOSC control PC. This software allows users to click on any star in the field image to instantly obtain its FWHM, significantly improving the efficiency of the focusing procedure. The interface and FWHM output for a selected star in the ADFOSC field is shown in **figure 66**.

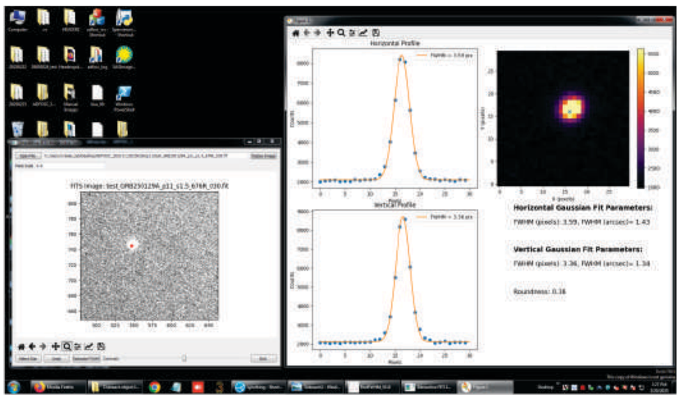



***Figure 66.*** *Screenshot of the interactive FWHM estimation tool. (left) The user-selected star within the field image. (right) Corresponding FWHM value computed by the software.*

### 4.6 DOT Online Proposal Submission and Evaluation System (DOPSES)

A new DOT Online Proposal Submission and Evaluation System (DOPSES) is being developed on the Python platform in-house by the computer section after incorporating inputs from the DOPSES Team, DTAC Members, and users' feedback.

## 5. Pointing models for ADFOSC and TANSPEC

An accurate pointing model is crucial for precisely targeting objects in the sky, especially for instruments like TANSPEC and TIRCAM, which have a small FoV (up to 1 arcminute). It is equally important for the effective use of the Acquisition and Guiding Unit (AGU), which also has a similar FoV. If the telescope pointing is off by more than this limit, the AGU cannot be used effectively. Instrument validation and testing (IVT) nights were utilised to generate accurate pointing models for both ADFOSC and TANSPEC. Approximately 100 stars distributed across all four quadrants of the sky were observed to collect the pointing data. This data was processed using the TPOINT software to develop pointing models with a root mean square (RMS) accuracy of less than 2 arcseconds. These finalised pointing models for ADFOSC and TANSPEC were deployed on the TCS PC for use during observations. The implementation of these models has significantly improved AGU usability and minimised the amount of manual offsets to align sources within the slits of ADFOSC and TANSPEC. This procedure will be repeated every time after mounting the instrument.

## 6. Overall subscription factor

The recent efforts to enhance the overall performance of the 3.6m DOT have been highly successful. Significant improvements have been observed in the quality of scientific data, particularly due to the enhanced capabilities of the AGU system, which now allows users to perform longer exposures, resulting in high signal-to-noise ratio data. Additionally, the development of dedicated software tools to streamline observation procedures has proven effective, resulting in a considerable reduction in overhead time. This has

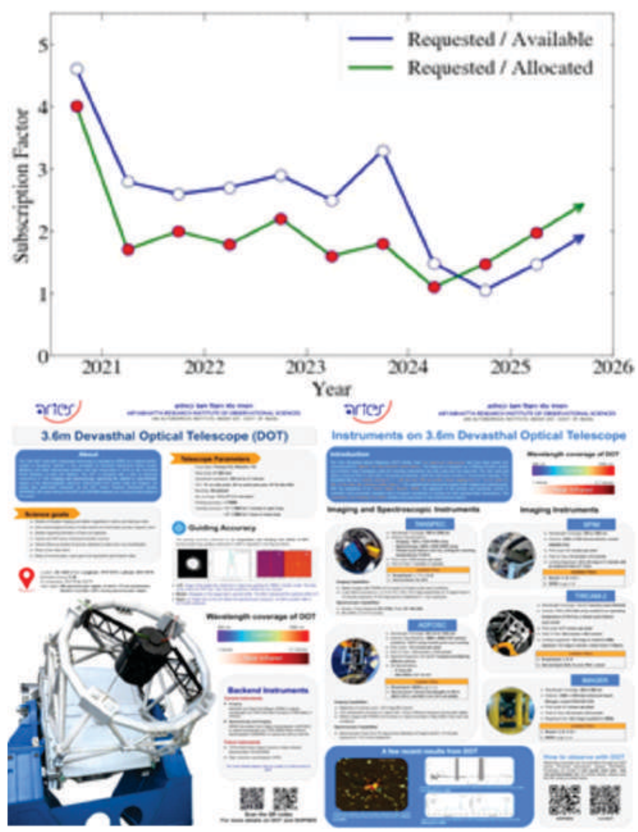



***Figure 67.*** *The increasing subscription factor of the 3.6m DOT in recent years highlights its growing scientific demand. To further enhance the telescope's visibility and attract more proposals, showcasing posters were presented at the 43rd Annual Meeting of the ASI.*

enabled observers to utilise their allocated time more efficiently for scientific observations. To showcase these advancements, posters highlighting the upgraded capabilities of DOT were presented at the 43rd meeting of the Astronomical Society of India (ASI) during 15–19 February, 2025 at the National Institute of Technology, Rourkela.

The overall subscription factor for DOT is starting an upward trajectory, reflecting growing interest and confidence in the facility. With these continued improvements, a higher number of proposal submissions is anticipated in the coming cycles.

- Regular DOMU and DTAC meetings were conducted, and their recommendations were taken into account.
- A new annual maintenance contract was signed with AMOS for the period October 2024 to September 2025, which includes administrative support, 80 hours of remote technical assistance.
- The M1 mirror of the 3.6m DOT is currently coated with bare aluminium, which suffers an annual reflectivity loss of 10–20% due to environmental factors such as dust and humidity, despite regular $CO_2$ snow cleaning. As a result, recoating has been required every two years since 2015. To address this, ARIES is planning to upgrade the coating facility to support protected aluminium coatings, which offer longer durability and reduced maintenance frequency.
- Primary mirror re-aluminization of 3.6m DOT is scheduled in the 2025 monsoon to revive the mirror reflectivity. Appropriate preparations, including health runs of the coating plant, sample testing, dummy mirror rehearsal with building cranes etc., are going on to ensure the successful completion of the recoating mission.
- A PM2.5 dust monitoring instrument was installed on the 3.6m DOT telescope floor to track indoor dust levels. The system is actively logging data, which is currently under analysis.
- Devasthal Engineering laboratory: It includes an electronics laboratory, an optics facility, an environment-ally controlled storage room, office space and a meeting room. At present, various instruments, items etc., are being procured to set up the facility.
- Executed a comprehensive preventive maintenance plan for all major mechanical systems within the DOT facility. Completed various post-monsoon activities for the 3.6m DOT enclosure. Repaired the motor of one slit door of the DOT dome by disassembling it from its gearbox, restoring operation.
- Pre-Fabricated Buildings for Accommodation and Night Operations: To address the accommodation needs of Project Scientists (3) and Scientific Operators (10) involved in night duties, as well as to provide a rest area for observers, operators, and support staff during nighttime observations, total four pre-fabricated huts have been planned.

***Figure 68.*** *Top row: Office space made ready in the engineering building. Bottom row: The work in progress for the prefabs for the living space.*

## 7. Updates from existing instruments

**ADFOSC:**

- Prior to the start of observations, the CCD experienced a vacuum failure. A leak test on the ADFOSC dewar revealed a chipped field corrector lens, which was promptly replaced with an available spare.

- A procurement order for two additional spare field corrector lenses has been placed. A spare compressor is to be procured.
- Spectro-polarimetric test observations were also conducted using Double-Wollaston prisms (procured under SRG/SERB), including several polarised and unpolarised standard stars.
- A dedicated spectro-polarimetric data reduction pipeline is under development.
- The Autoguider was successfully used with ADFOSC for long-exposure observations (>1 hour) by multiple users.
- A quick-look spectra viewer app was created to assist the night observer in real time. Data headers of previous cycles are being updated.

**SPIM:**

- At present, a 4k×4k CCD from ANDOR, procured in January 2023, is installed on the SPIM. This CCD can be thermo-electrically cooled to -80°C, with a coolant temperature of 10°C. With a pixel size of 15μm, the CCD provides a FoV of approximately 6.5×6.5 arcminutes. It has a peak quantum efficiency of over 95% and offers multiple readout speed modes (0.1, 1, 2, and 4 MHZ). SPIM covers a wavelength range of 350-1000 nm, making it well-suited for studying star-forming regions, star clusters, transient sources, active galactic nuclei, variable stars, and more.
- SPIM was mounted on the side port of the 3.6m DOT during the last observing cycle. Calibration tests were conducted, which included assessing filter movement and bias stability. Additionally, CCD characterisation, photometric calibration, and site characterisation (including extinction coefficient calculations) were performed. An issue with the filter movement was identified and resolved through a gear replacement. A new graphical user interface for filter control was developed. The instrument was released for observations during the observing cycle DOT-Cycle2025-C1.

**TIRCAM 2:**

- TIRCAM2 was operational until mid-November, 2024, after which its cooling efficiency declined. It was scheduled for re-pumping during the next instrument changeover. However, during the ADFOSC changeover on 16 November, 2024, the helium lines of TIRCAM2 were damaged, resulting in contamination. As a result, it could no longer achieve the required cooling. During the servicing, the lines were replaced, a new adsorber was installed, and helium purging and refilling were carried out. It was tested by connecting the TIRCAM2 cold head, but the instrument still could not reach the desired temperature. Following further inspection, servicing of the compressor cryohead was recommen-ded. The same has been scheduled during the coming monsoon.

## Upcoming instruments:

### TIFR-ARIES Multi-Object Optical to Near Infrared Spectrometer (TA-MOONS):

- ARIES completed the design of the telecentric corrector, probe viewer and calibration system, with finalised mechanical concepts after a team visit to TIFR. The backend two-arm spectrograph optical design was improved, and two design families were prepared for the upcoming Preliminary Design Review (PDR) trade-off studies. The target acquisition simulation was also completed.
- TIFR finalised and optimised the front optics design presented and published in SPIE 2024, Japan. The front optics mechanical design was completed and has also been presented and published at SPIE 2024. All precision moving components of the prototype arm development were completed, including in-house fabrication of a compliant mechanism-driven motion stage as well as precision rotation stages.
- The Teledyne H2RG detector was successfully procured with government approvals.
- All critical item prototypes were successfully completed, and PDR is proposed in the near future.

### DOT High Resolution Spectrograph (DOT-HRS):

- The vendor sent an official request to ARIES for the project extension. ARIES formed a national-level committee to comprehensively review the vendor's request for an extension and assess its impact on the HRS Instrument Development Project. The committee recommended the project extension till

December, 2026, and accordingly, the amended contract was signed between ARIES and the vendor. The regular updates from the vendor in the form of monthly update reports and quarterly project reviews are being received by ARIES.

- The spectrograph vacuum chamber and detector cryostat were received at the vendor's factory, and the leak test has been passed. Several critical optical components, e.g. spectrograph camera lenses, slicer optics, collimator mirror, echelle grating, ADC optics, and beam splitter optics, etc., have been manufactured. Suitable AR, or reflective coating, was applied and tested for most of the optical components. Coating for the transfer mirror and slicer optics is in queue at the third-party vendor and expected to be completed soon. The vendor indicated that the cross-disperser prism correction is still pending at the third-party location, and the vendor is getting a quote from another third party to complete the prism testing and correction as per the updated schedule. RFQ has been sent to another third-party vendor for coating of the same prism. Thermal control ICD has been completed, and heaters and sensors for the radiation shield have been prepared. In the software part, the control task is progressing, the technical cameras and CCD task control have been integrated, and the OPC UA server integration is ongoing.

- A 3-ton capacity jib crane was installed by ARIES inside the telescope pier to facilitate the spectrograph assembly. A thermal control room was fabricated inside the pier to house the spectrograph. At present, some fine changes as per ARIES request and testing of the thermal control room are going on at the site.

## 4m ILMT

The 4m ILMT is a joint collaboration between India, Belgium and Canada. It is the only liquid mirror telescope in the world that is presently being used for astronomical observations. After the successful first light in April 2022, the telescope has been continuously surveying the sky. The performance of the telescope over the last year is briefly discussed below.

### Operations of the ILMT

Observations typically begin in October, following the monsoon season. System checks are performed for the CCD camera (vacuum pressure, cooling, etc.), the pneumatic system (compressor, valves, etc.), the Socabelec interface mechanisms (filter selection, CCD rotation) and the UPS. The main preparatory activities

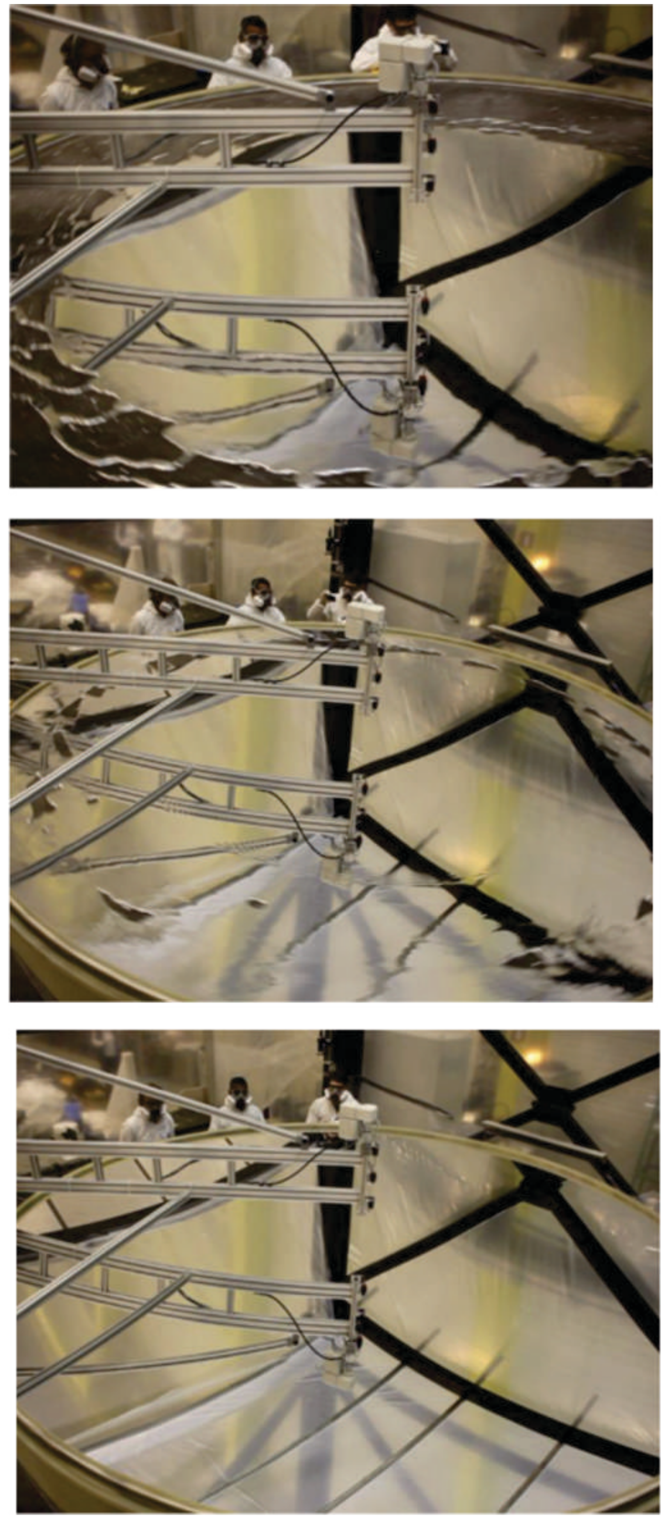


***Figure 69.*** *Three typical phases in the mercury mirror formation. The mirror rotation is (Top) accelerated to spread out the mercury, (Middle) rapidly decelerated and then accelerated to fill any holes in the mercury surface, (Bottom) maintained at the correct speed by engaging the control loop.*

that take place before starting the mirror are (1) primary mirror and air bearing azimuth alignment, (2) leveling the mirror and (3) Mylar installation and mirror formation **(Figure 69)**. A new precision tilt meter was mounted in the rotary table assembly to aid in monitoring the leveling of the bowl. The engineering check and final adjustments are made on the first night after the mirror is started. The TDI scan rate of the CCD camera is optimised. Dark images are taken to check for light leaks, and star images are used to determine the best focus. The CCD's azimuth is adjusted if needed to align its columns with the E–W direction. Defocused star images help check the optical corrector's alignment. If required, the corrector is centred using E–W and N–S micrometres. Once focus is restored and autofocus engaged, science observations begin. During the observing season, the mirror runs continuously for months, and the mylar film is periodically cleaned with compressed air to remove dust and insects.

## Data acquisition and analysis

The ILMT is equipped with a 4k×4k pixel Time-Delayed Integration (TDI) mode CCD camera, featuring 15 μm pixels (0.3276 arcsec/pixel), manufactured by Spectral Instruments. It operates over the 400–1100 nm spectral range and is cooled to −110°C using a closed-cycle PT-3 cryo-cooler to minimise dark current. The telescope uses three filters - g′, r′, and i′ - with central wavelengths of 468.6 nm, 616.5 nm, and 748.1 nm, respectively, each with a typical bandwidth of about 150 nm. These filters match the SDSS photometric system.

A single TDI scan lasts 102.35 seconds, corresponding to the time required for a source to traverse all 4096 rows of the CCD. Science observations consist of a continuous series of ten such scans, constrained to about 17 minutes by the camera software. Each resulting image measures 36864 × 4096 pixels, covering 200.9 × 22.3 arcminutes or 1.25 square degrees approximately **(Figure 70)**. The telescope scans a fixed sky strip centered at +29°21′41.4″ declination. On average, about 36 square degrees are imaged each night, accumulating to around 115 square degrees annually. This produces approximately 15 GB of data per night. **Figure 71** shows the sky coverage of the ILMT survey as of June, 2024.

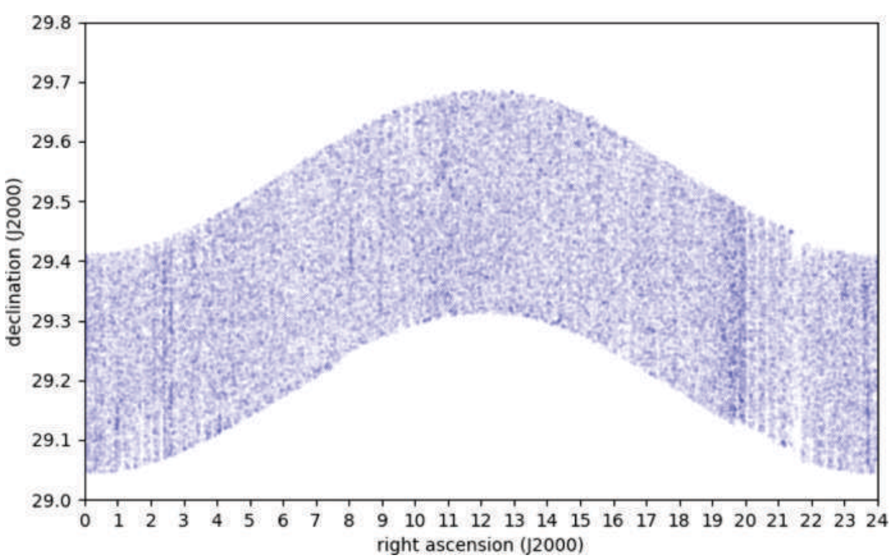



***Figure 71.*** *Sky coverage of the ILMT survey, as of 15 June 2024. Each dot represents 200 sources in the preliminary source catalogue.*

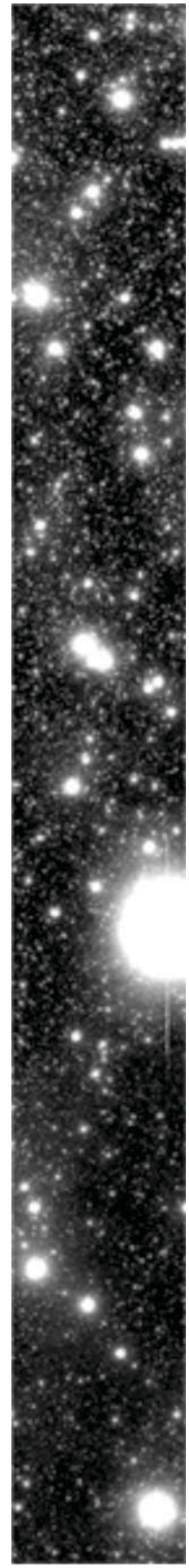


***Figure 70.*** *Example of a single CCD frame recorded in the TDI mode during ~17 minutes.*

Raw images are automatically pre-processed by the OCS software to remove instrumental effects. Dark and flat-field corrections are applied in one dimension, since TDI averages pixel responses along columns. Astrometric calibration yields a positional accuracy of better than 0.1 arcsec. The photometric calibration is obtained by estimating aperture magnitudes and calibrating them with respect to the Pan-STARRS-1 and Gaia reference catalogues. Co-adding images of the same portion of the sky across observing seasons improves the limiting magnitude by up to 1.8 mag.

The ILMT is highly effective for detecting optical transients. An automated pipeline (PyLMT) performs image subtraction and employs a convolutional neural network (CNN) for transient classification. This system identifies variable or transient sources, including those superimposed on extended objects such as multiply imaged quasars or supernovae. **Figure 72** shows an ILMT detection of a supernova SN 2024cjb in 'i' band with the PyLMT pipeline.

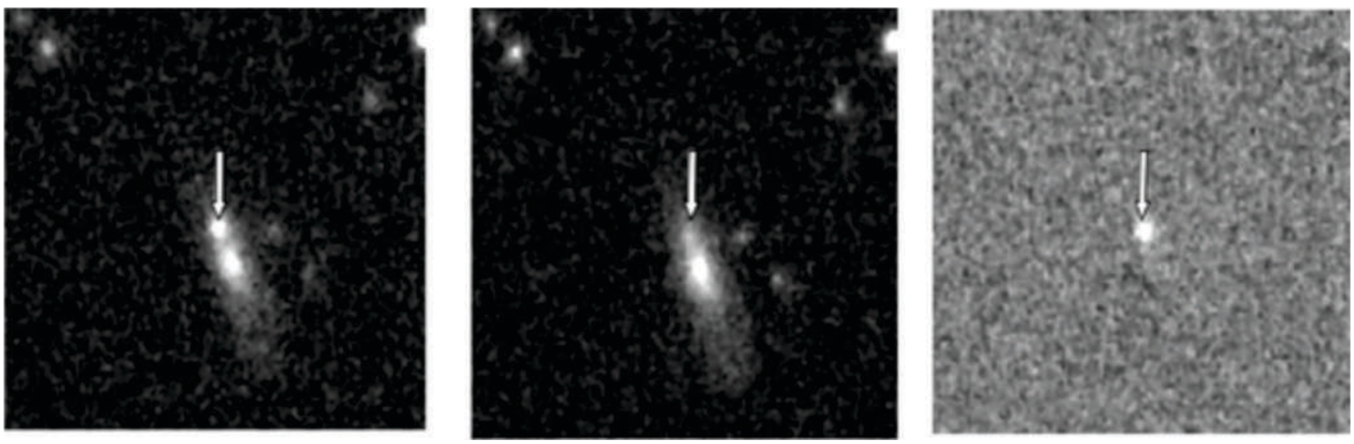


***Figure 72.*** *ILMT detection of the SN 2024cjb in the i'-band. Left: Detection of SN 2024cjb on 16 February, 2024. Middle: Image recorded on 9 February, 2024 representing the reference image to be subtracted from the previous one. Right: The subtracted image with a white arrow indicating the location of SN 2024cjb.*

## Performance of the ILMT

The ILMT uses a mercury mirror with 76% reflectivity—lower than aluminium or silver—but maintains consistent performance since the mirror is refreshed each time it operates, unlike conventional mirrors that degrade over time. The mylar film stabilises the mirror surface but causes some light loss and scattering, reducing the throughput to about 55–58%, compared to ~87% for glass mirrors. This results in a ~0.4 mag sensitivity loss.

Image quality is mainly limited by atmospheric seeing, with a median of ~1.2 arcsec. Early in the night, internal turbulence can degrade seeing to 2–3 arcsec, but it improves to 1–2 arcsec as the enclosure cools. The optical corrector ensures uniform image quality across the field. Limiting magnitudes per 102s exposure are 21.9 (g′), 21.7 (r′), and 21.5 (i′), with potential to reach >22 mag under ideal conditions.

## Science with the ILMT and data availability

Some research programmes, such as long-term surveys and photometric monitoring, are often impractical with conventional telescopes but are well-suited to dedicated survey instruments like the ILMT. Since the ILMT scans the same region of sky nightly, it is ideal for studies focusing on astrometric and photometric variability rather than targeting a specific target in the sky. Early scientific results from the ILMT include the detection of solar system objects, low surface brightness galaxies, and both galactic and extragalactic sources. An unexpected but valuable application has been the detection of artificial satellites and space debris **(Figure 73)** - 301 tracks were recorded in the first observing season, with about one-third corresponding to previously uncatalogued objects ranging in brightness from V = 6.4 to 19.5 and altitudes spanning from low-Earth to cislunar orbits. The ILMT survey data is available to the scientific community via the ARIESCloud service. At present, it includes three main observing runs from October, 2022 to December, 2023. The data are organised by observation date and follow a naming convention that includes the date, filter, and local sidereal time (LST), which corresponds to the right ascension of the first recorded object. Data statistics between April, 2024 and March, 2025 are shown in **figure 74**.

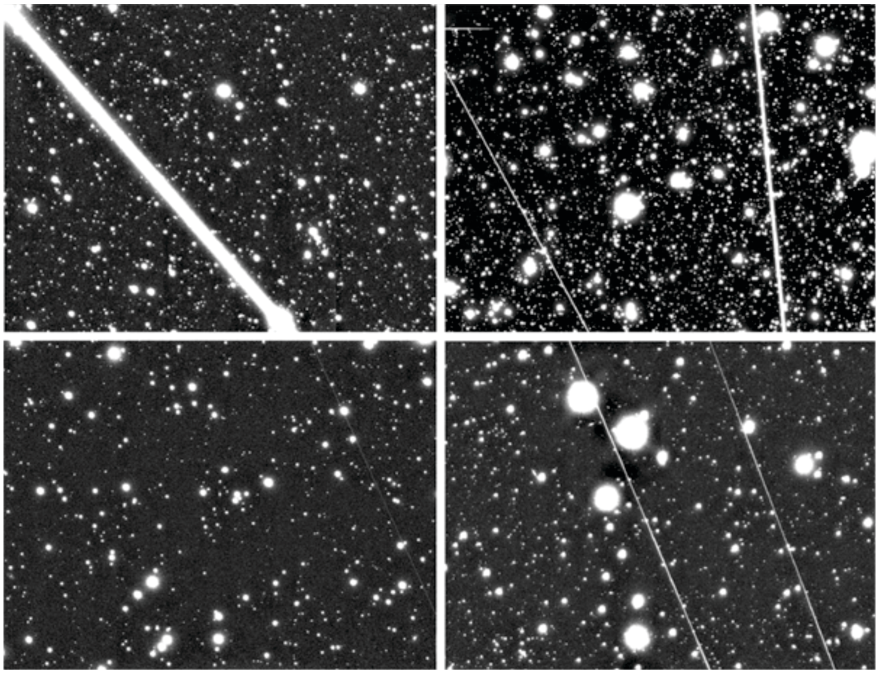


***Figure 73.*** *Streaks produced by six correlated objects detected by the ILMT. Clockwise from top left are STARLINK 1450, FREJA, METEOR 2-15, SL-6 R/B, COSMOS 2063, SL-12 R/B.*

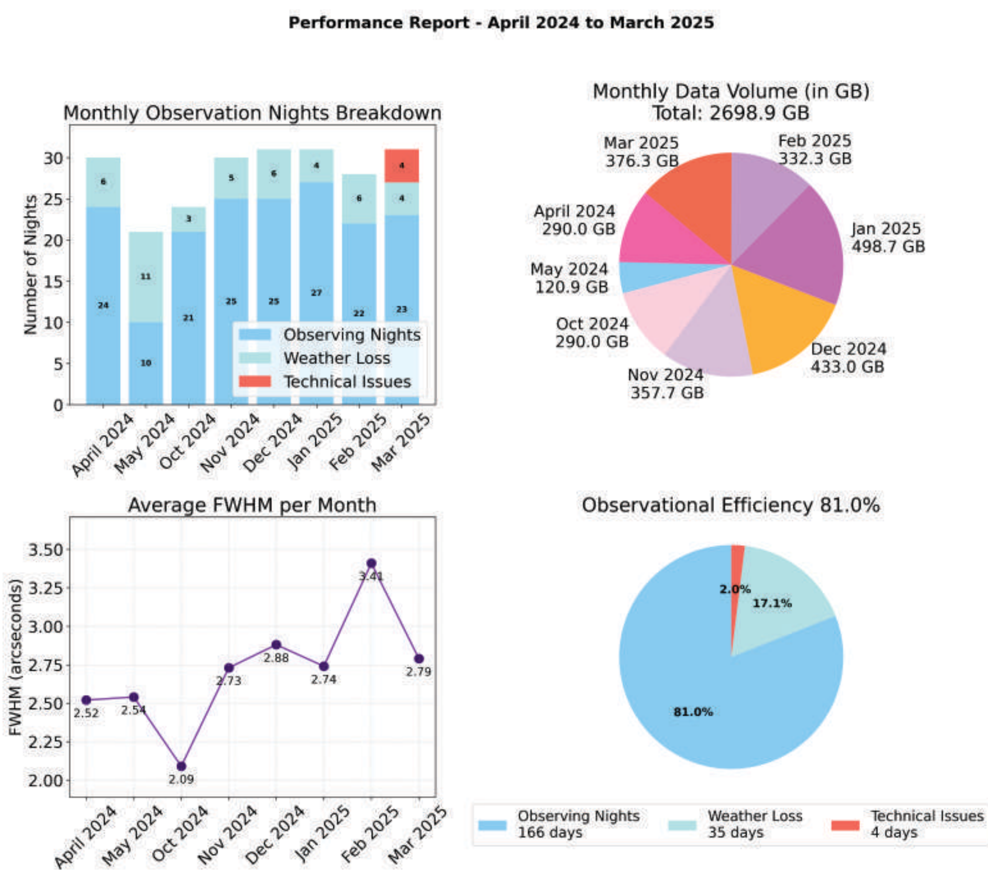



***Figure 74.*** *Performance overview of ILMT for 2024-25.*

## 1.3m DFOT

The 1.3m Devasthal Fast Optical Telescope (DFOT), located at Devasthal, serves as the primary facility for conducting photometric observations for various scientific programmes at ARIES. Currently, the DFOT is equipped with two CCD imagers: a 2k×2k CCD imager and a 512×512 pixel frame transfer imager. These imagers are used interchangeably based on the specific needs of the observer. With the capability to achieve sub-millimag photometric stability, the DFOT enables the detection of minute photometric variations.

The DFOT features a filter assembly that can accommodate eight filters simultaneously. 13 broadband and narrowband optical filters are available, including UBVRI, ugriz, Hα, SII, and OIII. Additionally, the facility is equipped with an auto-guider unit and a GPS-enabled weather monitoring system to support observations. The primary scientific programs conducted with the DFOT include monitoring transients such as gamma-ray bursts (GRBs), supernovae, exoplanets, and occultation events. It is also used for searches of variable stars in star clusters and the Galaxy, as well as for observing episodic events like active galactic nuclei (AGN) and X-ray binaries. Other pursuits include optical imaging of open and globular star clusters and the study of galaxies.

Proposals for observing with the DFOT are evaluated by the Joint Time Allocation Committee (JTAC). For 2024-25, a total of 240 observing nights were allocated. Scientific data was successfully collected on 172 nights, while 49 nights were lost due to adverse weather. The remaining 19 nights were lost due to technical issues. Furthermore, more than 15 research papers were published in prominent academic journals, along with numerous circulars and conference proceedings based on DFOT observations.

## 104cm ST

During 2024-25, two instruments were mounted on the 104cm Sampurnanand Telescope (ST): (i) AIMPOL for polarimetric observations with a 512×512 pixel CCD and (ii) 4k×4k imager. This period included 2 months of 2024A cycle, full 2024B cycle, and 2 months of 2025A cycle. In total, 47 proposals were allocated observing time. Out of 168 nights allocated, observations were carried out on 88 nights and the rest were affected by bad weather. Using the data acquired from this telescope, 5 conference papers and 7 full papers have been published in peer-reviewed journals.

To improve the telescope performance, an auto guider camera was mounted and tested on the 8-inch finder telescope. Initial tests showed good tracking with no star trails in 300 second exposure images. Further tests with the auto guider will be carried out in the upcoming cycle. An environmental monitoring system was set up in the telescope building to measure temperature and humidity at every two seconds and display them on the observer room computer. A GPS system tested at site provides longitude, latitude, altitude and UTC. Wire and component tracing are being carried out meticulously to prepare necessary documents and manuals for future maintenance and upkeep of the facility.

As part of the telescope and dome automation, an encoder for the RA axis was installed by means of a mechanical coupler fabricated in the mechanical workshop. It provides accuracy within 100 microns. DEC encoder has been procured and will be installed soon.

## ASTRAD

The 206.5 MHz ARIES Stratosphere Troposphere Radar (ASTRAD) was operated extensively from April, 2024 to March, 2025 for various scientific observations, both in collaborative and individual modes, following different scientific plans, including the study of extreme weather events. In addition to the new observations, historical data was used to characterise the atmospheric wind field, marking the first such effort in the Central Himalayan region using high-resolution wind data from the radar. During this process, in one of the work ARIES, Nainital, and SPL, Trivandrum did a comprehensive collaborative work to characterise vertical wind patterns during the summer monsoon.

Analysis reveals a two-step vertical motion of air parcels from the surface to the upper troposphere and lower stratosphere over the Central Himalayas. Downdrafts are present below 4–6 km, followed by general updrafts between 7–9 km, and consistent downdrafts between 10–11 km. Above 12 km, corresponding to the Convective Tropopause (COT),

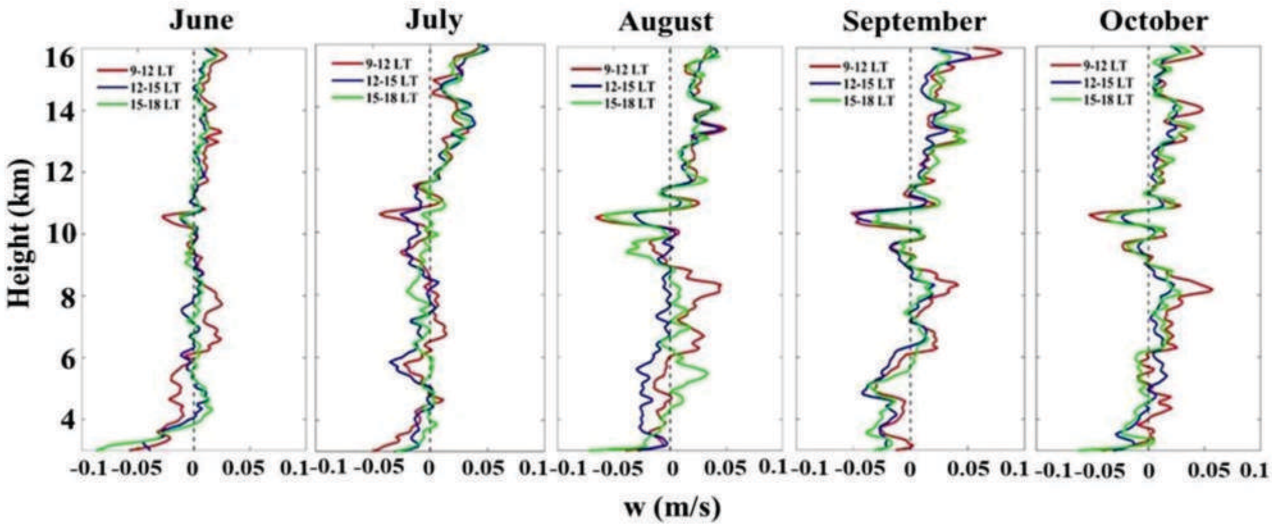



*Figure 75. Direct measurement of vertical air motion during the Indian Summer Monsoon using ASTRAD data for 2022-23 over the central Himalayas inside ASMA region.*

persistent updrafts are observed throughout all months between 9–18 LT.

The radar observations were utilised to characterise and report a Western Disturbance (WD) episode through the first-ever direct high-resolution atmospheric wind measurements over the central Himalaya, highlighting the importance of WD and Subtropical Westerly Jet (SWJ) **(Figure 76)** in the region's weather. During the observation period from 1 to 4 March 2024, the WD was found to be associated with strong winds of around 67 m/s and unstable atmospheric conditions, with updraft up to 0.26 m/s and downdraft of 0.5 m/s. These conditions triggered non-monsoon convective events and resulted in rainfall. Furthermore, the observations indicated a shift in the altitude of the high-speed wind core, which varied between 11 and 16 km above sea level.

The upgradation of the ASTRAD facility has

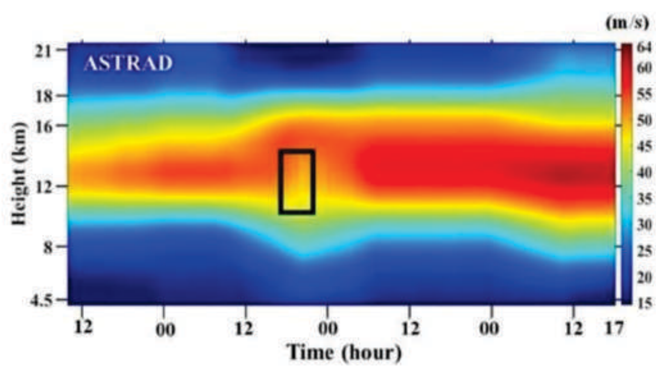



*Figure 76. Time and height variation of wind speed from 10 hours on 1 March 2024 to 17 hours on 4 March 2024, showing the position of SWJ with a shift in height of the maximum wind speed marked in a black box.*

progressed systematically in a planned manner, focusing on active aperture networking, radar control, and digital signal processing. Phase 1 included the replacement of the High-Power Amplifier (HPA) of Transmit Receive Module (TRM) with an in-house designed and fabricated upgraded HPA **(Figure 77)**. Phase 2, aiming to upgrade 150 TRMs with the new HPA, has begun. As part of this, 150 new SMPS-based power supplies, designed in-house, were procured and installed in clusters. New HPAs were fabricated in-house and integrated into the old TRMs, with each unit tested in the laboratory for performance verification before final calibration.

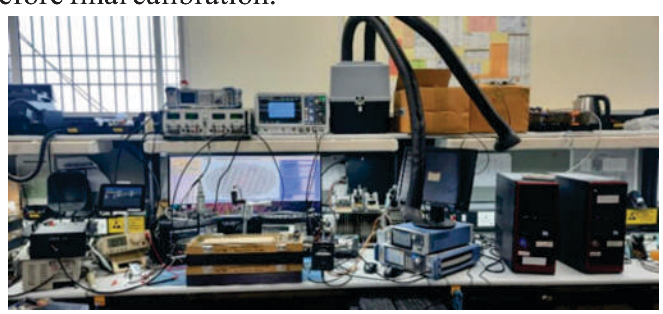


*Figure 77. TRM with new HPA is under test in ASTRAD RF Laboratory.*

The design and planning for an advanced radar controller were completed, and the implementation is underway to improve data handling and observation scheduling along with the signal processing system. All these upgrades, driven by in-house design and testing capabilities, were planned in collaboration with private sector partners to ensure the long-term sustainability and innovation of the facility.

In addition to the upgradation work of different subsystems of ASTRAD, the first stage of TRM PCBs modernisation of one section was completed and capability was developed to produce radar antenna using in-house design and production facility.

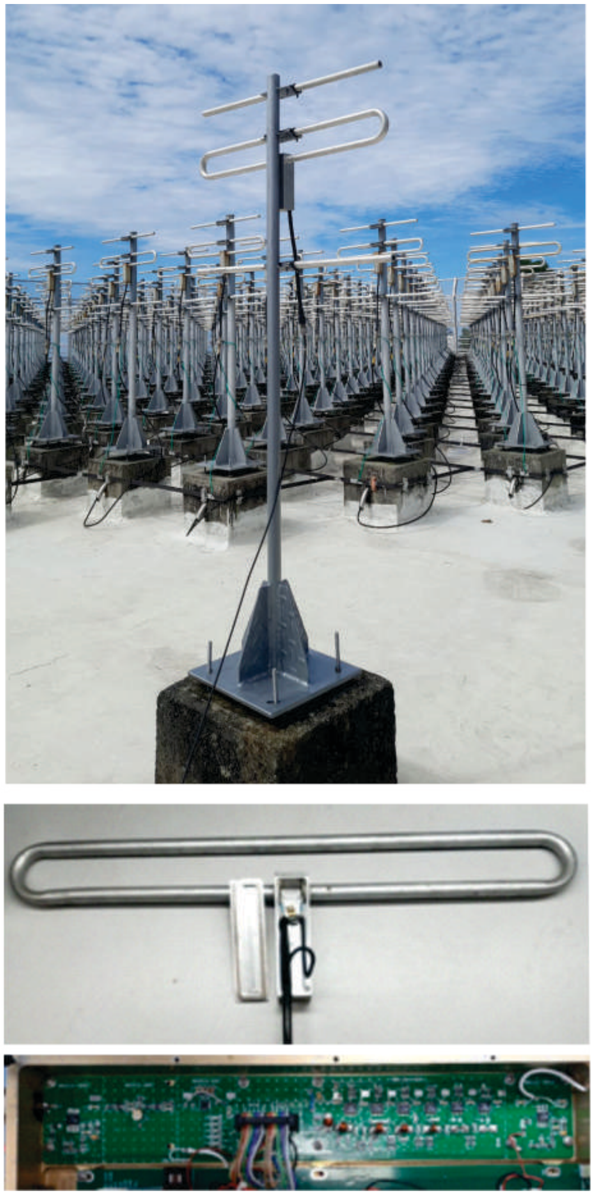


***Figure 78.*** *Top: In-house design, developed and fabricated three elements Yagi-Uda antenna under testing along with the phased antenna array (background). The antenna in (Top) is integrated with modified BALUN (Middle) developed and fabricated in-house. The common path of TRM is redesigned and upgraded with single PCB design to improve reliability (Bottom).*

Planned procurement of different items for various upgradation and maintenance works was executed, and scheduled maintenance and calibration of the entire system continued smoothly. After calibration, as a standard practice, the wind product obtained from the radar was compared with collocated balloon measurements for validation, and one of the comparisons on 20 November, 2024 showed good agreement **(Figure 79)**.

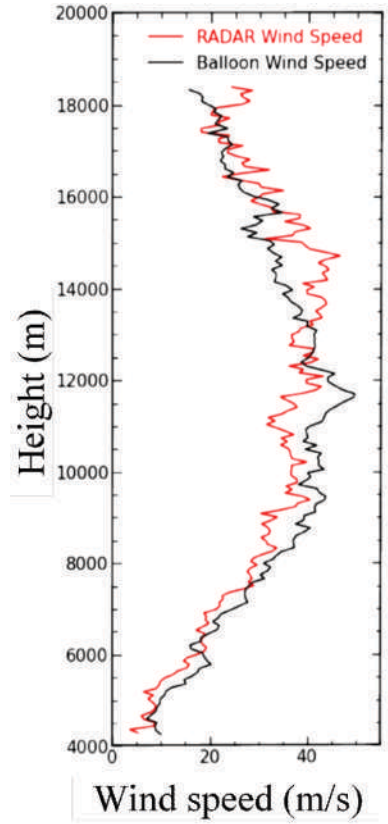



***Figure 79.*** *Comparison of wind speeds obtained from the ASTRAD and a balloon launched from the same site on 20 November, 2024.*

## High Altitude Climate Change Laboratory, Devasthal

Atmospheric aerosols, both natural and anthropogenic, play a critical role in atmospheric as well as astronomical sciences. These aerosols affect the atmosphere by perturbing the radiative balance of the Earth-atmosphere system as well as the degradation of the environment. To better understand the effects of aerosols on our environment, and hence climate change, it is important to characterize their physical and chemical properties over different locations due to large spatio-temporal variations of their properties. The aerosol observations at higher altitudes above the mixing layer and in the free troposphere would be indicative of the background level and significantly useful to understand the long-term impact. In this context, aerosol observations have been initiated over the last two decades, and now there is a plan to upgrade the high-altitude aerosol laboratory with state-of-the-art instruments and rename it as the High-Altitude Climate Change Laboratory at Devasthal.

# New infrastructure at Devasthal

The infrastructure at Devasthal Observatory was expanded to fulfill the requirements of the increasing research and development activities. The Honourable Governor of Uttarakhand Lt. Gen. Gurmit Singh (Retd.) visited Devasthal on 18 June, 2024 and inaugurated the newly constructed Engineering Lab, Mechanical Workshop and Surya Hostel Block. On this occasion, the honourable governor also felicitated five ARIES scientists and staff who have played a crucial role in developing the Devasthal site into a world class astronomical observatory.


***Figure 80.*** *Glimpses from the visit of the Hon'ble Governor of Uttarakhand and felicitation of ARIES staff at Devasthal Observatory.*

*The Engineering Division is responsible for the design, development, maintenance, and upgrading needs of ARIES, with a primary focus on astronomical telescopes, backend instruments, and equipment related to atmospheric sciences. It also plays a key role in the development and upkeep of the institute's infrastructure. This multidisciplinary division is organised into four sections: Mechanical, Optics, Electronics & Electrical and Computer. Laboratory resources are flexibly shared among the sections across the ongoing projects. The division ensures smooth management of site activities, preventive maintenance of observation facilities, project execution, and system engineering tasks.*

**Collaborations:**

- Academia – IITs (Kanpur, Hyderabad, Bombay, Jodhpur), BHU, IISc, TIFR.
- ISTRAC-ISRO, IRDE-DRDO, and BEL Ghaziabad – SSA telescopes, observational techniques, software, and sensor development.
- Indian MSMEs – Optics, Mechanical Components, controllers, drives, software, and fabrication.

## Mechanical Section:

The mechanical section is equipped with a comprehensive workshop, housing a variety of machines, including a CNC vertical machining center, conventional equipment such as lathes, milling machines, radial drilling machines, surface grinders, mechanical power hacksaws, air compressors, TIG welding machines, as well as manual and heavy-duty trolleys for material and equipment handling. The section's engineers are skilled in using design and simulation software like Pro E, ANSYS, and AutoCAD for the computer-aided design and manufacturing of complex mechanical systems. Major activities during 2024-25 are described below:

### 1. Thermally controlled spectrograph room:

To house the upcoming high-resolution spectrograph for 3.6m DOT, a thermally controlled spectrograph room was fabricated and tested inside the telescope pier **(Figure 81)**. It has a 100 mm thickness of nitrile rubber as an insulating material for the walls and PUF (polyurethane foam) panels for the ceiling and doors. An HVAC system with a high-precision chiller was installed in the room to meet the stable thermal control (approx ±1 °C) requirement necessary for the spectrograph's

***Figure 81.*** *Thermally controlled spectrograph room with a 3-ton JIB crane to facilitate instrument assembly.*

performance. To achieve the active thermal control, a smart Air Handling Unit (AHU) with a variable flow system was used **(Figure 82)**. It has a capacity of 1200 CFM (Cubic Feet per Minute) and is equipped with PID (Proportional-Integral-Derivative) flow modulation. This allows real-time adjustments in airflow based on temperature and humidity sensor feedback, thereby ensuring a consistent and homogeneous distribution of conditioned air throughout the room.

***Figure 82.*** *Smart AHU (1200cfm with PID flow modulation).*

### 2. Mechanical Design of Calibration Unit for TA-MOONS project:

The calibration unit was compactly designed to fit within the limited mechanical envelope near TA-MOONS's input stage. It includes a mechanical assembly with precision optical mounts, rotary stages, and fiber injection modules.

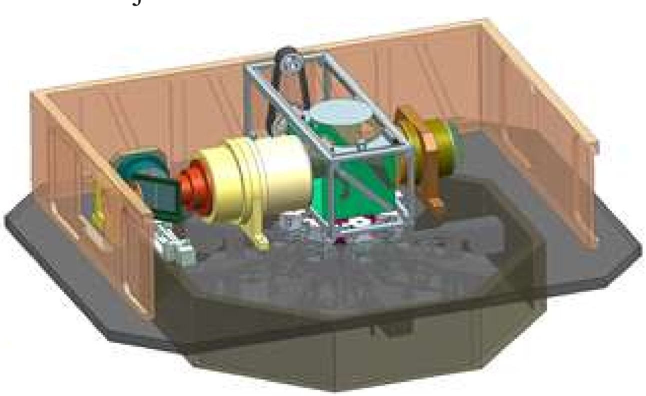


***Figure 83.*** *Concept design of TA-MOONS Calibration Unit.*

**3.** Design and fabrication of lens mounts, prism holders, encoder mounts, guider camera assemblies for telescopes, mounting brackets, housing components, etc., for various instruments and telescopes.

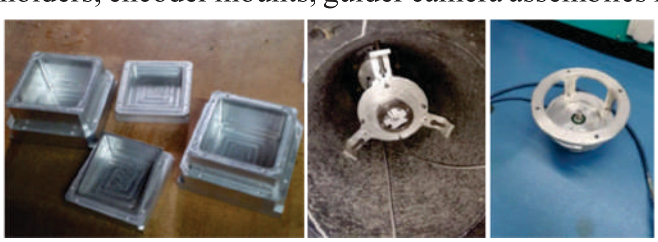


***Figure 84.*** *Mechanical mounts fabricated in the mechanical workshop.*

**4.** Fabrication of 15 antenna sets, power splitter boxes, and TRM units was carried out for the ASTRAD facility.

**5.** Routine and emergency maintenance of critical telescope infrastructure components, such as the chiller system, dome mechanisms, lift system, etc. was also supported.

## Optics Section:

The optics section is divided into two subdivisions: Design & Development and Facility Maintenance. It is responsible for maintaining all optical components of the observing facilities, including aluminum coating of telescope mirrors, ensuring the scientific quality of images and overseeing the assembly, integration, and testing of instruments prior to commissioning. The section also handles the optical design, development, and analysis of the astronomical instruments.

### Design & Development

TA-MOONS Optical Design: The optical design of TA-MOONS, which includes Optical channel spectro-graph, Infrared channel spectrograph, newer versions of probe viewer and calibration units, was completed. Several versions of designs were carried out, e.g. white pupil designs with reflective, transmissive gratings,

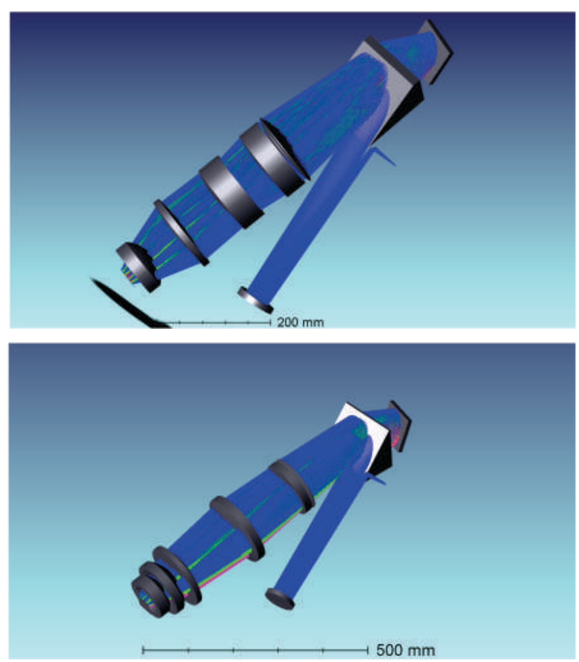



***Figure 85.*** *Optical layouts of two spectrograph channels.*

spherical/parabolic mirrors and the pseudo Littrow designs were finalised to get the desired performance.

## Preliminary design of the Side port FOSC:

A preliminary optical design was carried out for a newly proposed faint object spectrograph to be mounted on a side port of 3.6m DOT. It includes a guiding unit, acquisition unit, calibration unit, collimator and camera system. It is a faint object spectrograph of R~1000-1500, and was designed based on the existing FOSC platform.

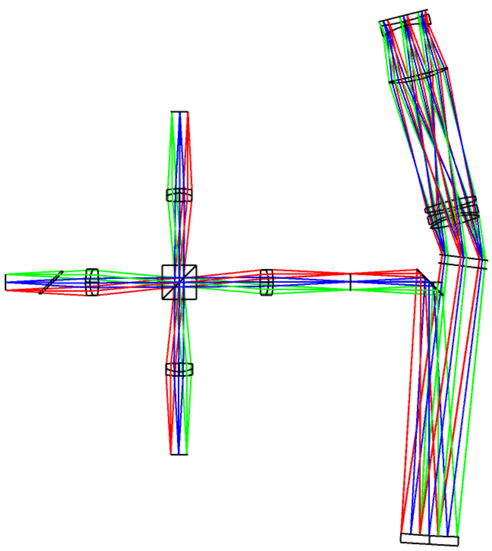


***Figure 86.*** *Optical layout of the side port FOSC design.*

## FOSC Spectro-polarimeter:

A dual Wollaston prism designed for FOSC was procured and assembled with its mount. Stellar sources were captured after integrating the setup with the FOSC broadband filter wheel.

## Corrector lenses for FOSC spare CCD:

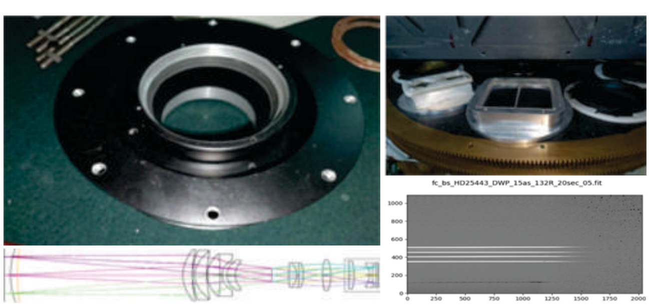


***Figure 87.*** *Left: FOSC corrector lens optical layout and lens in its mechanical mount. Right: Wollaston prism in mount and spectro-polarimetric image.*

A separate corrector lens was designed and its mechanical mount was fabricated.

## Observing Facility Maintenance:

**Axial definer pad re-glue:**

The axial definer #1 mirror pad got unglued from the 3.6 m DOT primary mirror surface. Because of that, the performance of the 3.6m DOT was restricted. The mirror pad regluing activity was carried out successfully in the second week of April 2024. Adaptor rotator instrument support structure (ARISS), Axial definer #1, and the adjacent actuator were unmounted from the telescope to get access to the unglued pad. The mirror surface and invar pad were inspected and cleaned thoroughly. After re-gluing, the pad was kept in a controlled environment for seven days for optimum curing. The glue strength was checked by mirror loading and unloading, and the force value at axial definer #1 was tuned. The image quality test of 3.6m DOT confirmed that the telescope performance was restored. This time, a new approach was followed, which enabled re-gluing the pad without unmounting the primary mirror from its cell. This new approach has saved valuable observing time.

**Actuator Maintenance:**

Three actuators (102, 418 and 419) were showing errors in Active Optics System (AOS) due to bias forces and faulty electronics. These faulty actuators were unmounted, and their piezo pneumatic valves were replaced with spare valves. Suitable shims of size 1mm were kept in the M1 cell to neutralise the bias voltages of #418 and #419 actuators. The #102 actuator was replaced with a spare one. AOS testing after the repair works showed that the system is working fine.

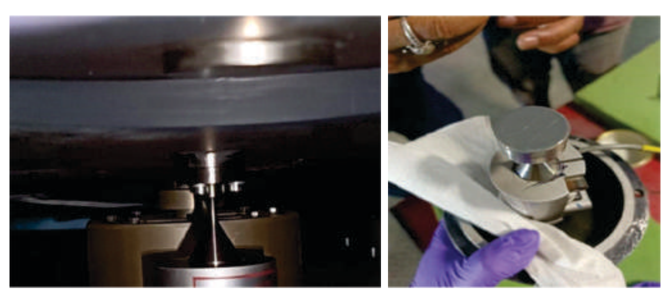


***Figure 88.*** *Axial Definer #1 re-gluing.*

The wavefront sensor CCD was mounted to the auto-guider unit of the 3.6m DOT. Earlier, it was unmounted to shuffle the cooling lines to the guider CCD. Power and USB lines were connected. It was tested with on-sky images and is working fine now. The Guider CCD was repaired, remounted and tested with on-sky conditions, following which closed-loop guider tracking was tested.

**104cm ST Primary Mirror re-aluminisation:**

Re-aluminisation of the 104cm Sampurnanand Telescope's primary mirror was carried out successfully. This activity included the mirror cell disintegration, unmounting of the mirror from the mirror cell, removal of old coating and application of fresh coating. This was followed by reassembly and realignment of the mirror with its cell, and then, reintegration of the mirror cell with the telescope.

***Figure 89.*** *Left: Primary mirror of 104cm ST ready to be loaded inside the coating chamber, Right: The primary mirror after fresh aluminium coating.*

**1.3m DFOT Primary Mirror cleaning:**

In-situ distilled water cleaning of the 1.3m DFOT primary mirror was carried out as part of optical maintenance before the start of the observing season.

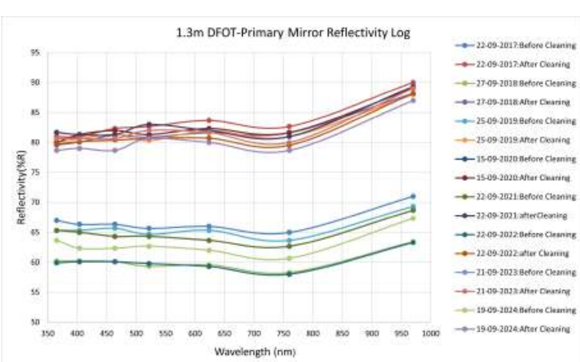



***Figure 90.*** *1.3m DFOT primary mirror's reflectivity before and after cleaning.*

The corrector and filters were cleaned and reassembled to their respective mechanical mounts.

## Electronics/ Electrical Section:

The Electronics Laboratory at ARIES serves as a dedicated R&D centre for in-house development and upgradation of telescopes and instruments using state-of-the-art electronics. The facility is periodically upgraded with current-generation technology and supports the design of industry-standard systems that can be adapted to a wide range of applications. The electrical section manages the installation and upkeep of the electrical infrastructure, including the central UPS system, SCADA-based substations, and power distribution networks for both office and residential areas.

**Facilities:**

- Modelling and simulation software and embedded systems
- Prototyping and emulation setups for motion control system
- FPGA platforms for developing CMOS and CCD imaging systems
- Hardware-in-the-loop (HIL) and rapid control prototyping systems
- Debugging, validation, and performance analysis instruments

**Key ongoing projects:**

- Expansion of the 3.6m DOT motion control system replica for training, significantly reducing dependency on foreign OEMs for critical operations and maintenance.
- Upgradation of the 1.3m DFOT with autonomous observation capability, establishing a baseline for future in-house upgradation of the 3.6m DOT.
- Development of novel CMOS sensor electronics for astronomy and object tracking.
- Development of a 60 cm wide field astronomy survey and SSA telescope.
- Development of a fast CMOS imager for high-contrast speckle imaging.
- Development of ground-based telescopes and instruments with BEL and IRDE-DRDO for

astronomy and SSA.

- Development of AI-ML-based software for cutting-edge astronomy and SSA.
- Modular HMI software development for robotic telescopes

## 1. Design and implementation of a Zero Crossing SSR (Solid State Relay) mechanism for the TANSPEC instrument:

To ensure the reliable operation of the TANSPEC instrument, a zero-crossing SSR mechanism was designed and implemented to resolve persistent electromagnetic interference (EMI) issues. The problem occurred when the power supply for the neon and argon calibration lamps generated electrical noise, causing the control GUI to frequently hang via interference with the network switch. The solution involved integrating a zero-crossing SSR, which precisely switches the lamps on and off only at the exact moment the AC power waveform crosses zero volts. This smooth switching action eliminates sudden


***Figure 91.*** *SSR relay mounted inside the TANSPEC instrument enclosure.*

current surges, thereby drastically reducing EMI and ensuring stable, uninterrupted communication over the Ethernet network for seamless instrument control.

## 2. Repair of faulty actuators for 3.6m DOT:

To ensure the uninterrupted and reliable operation of the 3.6m DOT, a critical repair task was undertaken on

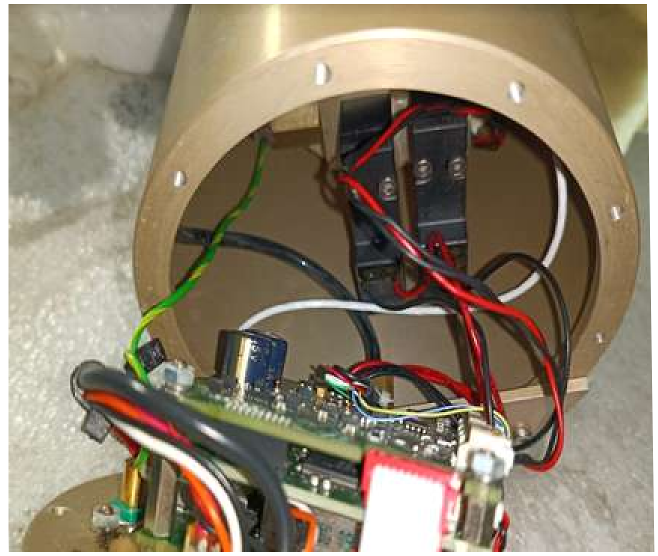


***Figure 92.*** *An actuator attached to the primary mirror of 3.6m DOT.*

its mirror shape actuators. The core activity involved the careful replacement of the defective pressure valves within the actuators with verified spare units.

## 3. Installation and development of a data monitoring and logging system for the tilt meter:

A new monitoring and logging system was set up for the Tilt Meter in the ILMT facility to ensure the telescope's stability. This system continuously keeps a track of the tilt of the mercury bowl, which is crucial for the ILMT's performance. A simple computer program (GUI) built with VB.NET shows the tilt readings in real-time and automatically saves the data with timestamps into text and CSV files. This allows for easy analysis of long-term trends and helps quickly troubleshoot any issues, providing a reliable record for maintaining the telescope's precision.

**4.** A temperature monitoring and logging system was successfully implemented for the four cemented pillars of the ILMT. Its corrector was mounted using the pillars, and any thermal expansion/contraction of the pillars can disrupt optical alignment. By correlating temperature variations with tilt meter readings, the system provides valuable insights into how temperature-induced shifts affect the bowl's stability.

**5.** An in-house electromechanical relay box was designed and developed to interface a newly procured autoguider camera with the 104cm ST. This relay boxensures reliable communication between the

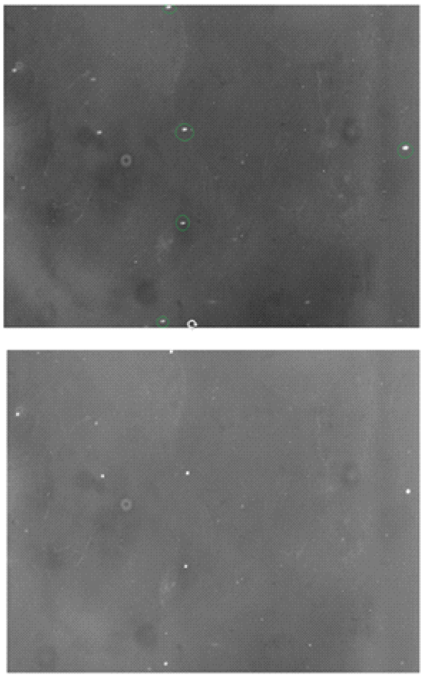


*Figure 93.* *300 second exposure image (Left) without guider (Right) with guider.*

camera and the telescope while providing electrical isolation for enhanced safety and performance.

**6.** A humidity and temperature monitoring system was developed for the 104cm ST to help protect its sensitive equipment. The system uses accurate DHT22 sensors (to measure the environment) connected to an ESP8266 board with built-in Wi-Fi. An on screen graphical user interface (GUI) shows the real-time data and automatic-ally saves all the readings into a log file for later review.

**7.** The Installation of Surge Protection Devices (SPD) and the Digital Grounding system to protect against lightning strikes and power surges across the entire Devasthal campus has been successfully completed.

**8.** The installation and testing of an Uninterruptible Power Supply (UPS) and battery bank system in the Engineering laboratory at Devasthal have been successfully completed.

## Synergy Between Astronomy and SSA Using Ground-Based Optical Telescopes:

In recent years, ARIES has established several MoUs with national organizations such as ISTRAC–ISRO, Bengaluru and Navratna Defense PSU BEL, Ghaziabad to foster strong synergies in astronomy and space situational awareness (SSA). These collaborations aim to jointly utilise observational facilities at ARIES and advanced laboratories and expertise of partner institutes for the development of advanced instruments and technologies serving dual purposes of astronomy and SSA. The scope of activities includes refurbishment and modernization of telescopes, development of software and backend instruments, and establishment of ground based observing telescope infrastructure. These initiatives are being carried out

*Figure 94.* *MoU signing between ARIES and BEL Ghaziabad.*

with active participation from students, project engineers, academia, and domestic industries, ensuring capacity building and self-reliance in critical technologies.

## Computer Section:

The Computer Section at ARIES is dedicated to delivering cutting-edge IT services and solutions that are pertinent and in line with the institute's priorities. It provides the latest, sophisticated, efficient and effective computational, network infrastructural facilities and services for the smooth functioning of both R&D and non-R&D facilities. The section manages the maintenance and upgrades of network devices, laptops, desktops, essential hardware, and software tools, along with providing improved and effective service to all IT users on a day-to-day basis. The engineers and technical staff are actively involved in numerous projects and R&D initiatives, mainly focusing on areas such as software development, programming assistance, database management, hardware/software application troubleshooting, networking, data collection, storage, etc.

### 1. Major facilities managed by the Computer Section are as follows:

- **High-Performance Computing (HPC) system – "Surya"** comprising one Master node and six Computing nodes (~300 cores, 384GB RAM, InfiniBand (IB) interconnect) for running complex parallel simulations, data models, or research experiments.
- **High-end centralised servers:** For handling computation-intensive R&D and non-R&D works.
- **GPU server:** Supporting 4608 CUDA cores, with peak performance of about 16 TFlops for handling image processing and AI/ML applications.
- **Dedicated servers/workstations:** For hosting and managing applications such as ERP, DOPSES, WebOpac, Data Archive, Repositories, etc., software licenses, and databases.
- **Specialised software:** Tools like Mathematica, MATLAB, Ansys, IDL, Origin, Creative Cloud, SigmaPlot, Autodesk, etc., for statistical analysis, modelling, and other research-specific applications.
- **Cybersecurity facilities:** These include firewalls, Anti-virus tools, data security and management tools, etc.
- **Cloud services and storage:** Platforms like AWS and institutional cloud services for hosting the institutional websites, and storage for file sharing and document management.
- Integrated indigenous ERP system: To manage and automate various administrative workflows.
- 24/7 Access to the computing facilities, and secured high-speed wired & wireless internet access across the campus.
- High-speed advanced MFPs (Mono/Color) with easy access for printing and scanning facilities for the users.
- CCTV infrastructure to enhance security, monitor activities, and safeguard data.
- Conference rooms and auditorium equipped with modern audio-visual (AV) systems, digital communication tools, and automation systems.
- ISDN PRI telephone facilities with seamless connectivity between the sites.

### 2. In-House Office ERP Portal

An in-house developed on-premises ERP portal (https://office.aries.res.in/) was released in October, 2024 with basic management functionalities – Employees/HR, notesheet, office orders, indents, and


***Figure 95.*** *Layout of the in-house developed ERP portal.*

resources. Later on, the portal was upgraded with additional modules, which include Leave Management, Tour Management, Attendance Management, and Helpdesk at different phases during the year 2025.

Some of the salient features of the developed Office ERP system are:

- Fully custom-built to suit ARIES's administrative and operational requirements
- Bilingual interface to enhance usability for all staff

- Role-based actions, action control, and hierarchical workflows
- Putting inline comments/remarks during approval cycles
- Real-time tracking
- Useful for back-and-forth clarifications without switching platforms
- Easy backend tools for user management and role mapping
- Multi-level approval processes
- Encryption of sensitive records in the database like files, photographs, signatures, passwords, etc.
- PDF/Excel/CSV export of reports, orders, and notesheets
- Pre-formatted ARIES letterhead templates for formal outputs
- Integration with biometric devices through API
- Responsive interface for smartphones
- Deployed on ARIES internal infrastructure for enhanced control
- Reduces external dependency and ensures data sovereignty
- Scalable framework allows for integration of future modules
- Automated email notifications on every action

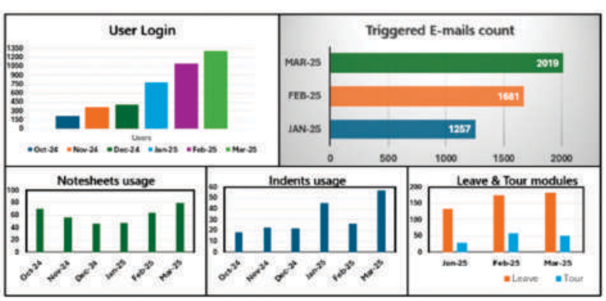



***Figure 96.*** *Usage statistics for some of the key aspects of the ERP.*

## 3. In-House DOT Proposal Submission & Evaluation System (DOPSES)

DOPSES application is developed in Django with PostgreSQL as the backend database. It will have some additional features compared to the old one. The application can be modified in-house and divided into three major parts:

- User Management (New User Registration/Creation of Profile, etc.),
- Application Submission (Mentioning of Objects/ Instrument selection/Requesting observing time, View previously submitted proposals, etc.), and
- Evaluation of submitted applications by Reviewers/ TAC Members/TAC Chair.
- The beta version of the application has been released for testing. The final version will be released after implementing all the corrections/ suggestions.


***Figure 97.*** *A screenshot of the beta version of DOPSES.*

## 4. ARIES ST Radar Data Access Portal

The computer section developed a portal through which users can select and download the ASTRAD datasets (Time series, Spectra, Moment, UVW, and WS/WD) for the selected dates.

***Figure 98.*** *A screenshot of the ASTRAD data portal.*

## 5.Micro-pulse LiDAR (MPL) facility

Engineering support was extended to revive the Micro-pulse LiDAR (MPL) facility, which had been non-operational since 2014. Through dedicated efforts and the development of an in-house software application, the system was successfully restored to operational status.

Data analysis for the MPL system was handled by the Computer Section. The figure shows the typical plots of the Range-Corrected Signal (RCS).

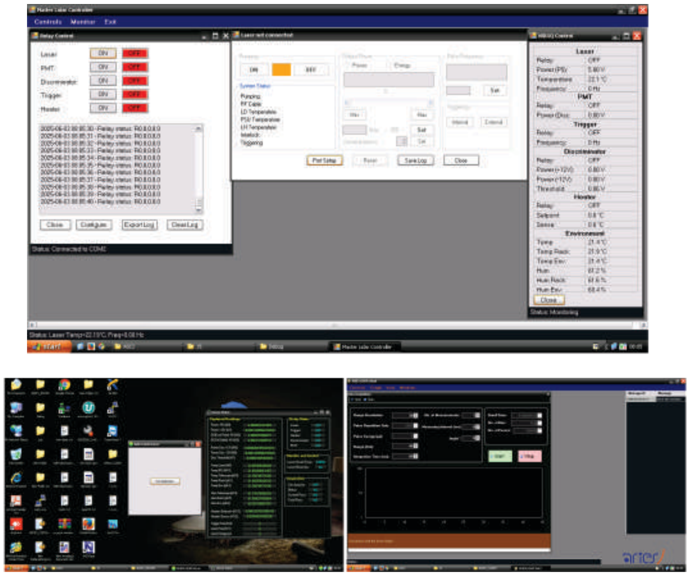


*Figure 99.* Screenshots of the in-house developed software for MPL.

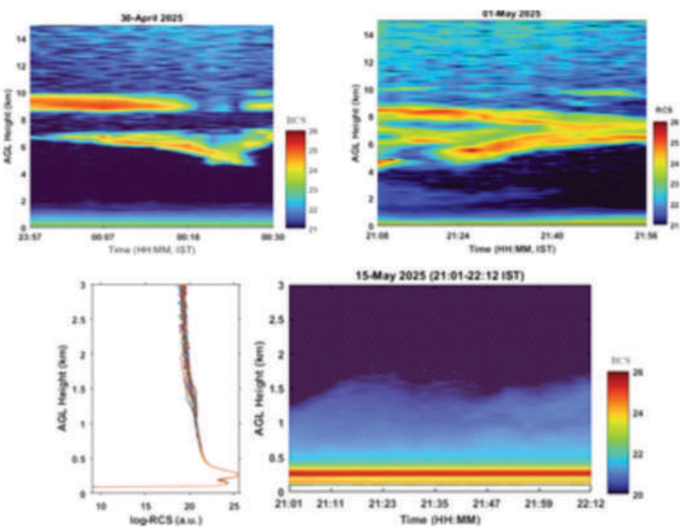



*Figure 100.* Range-Corrected Signal (RCS) from the Micro-pulse LiDAR.

## 6. Real-time network monitoring software

- Real-time network monitoring for all PCs connected to instruments associated with the 3.6m DOT.
- Ensures continuous tracking & monitoring of failure, enabling proactive maintenance.
- Multi-document interface (MDI) with multiple child forms.
- Device control, data acquisition, data visualisation, device status, log file viewing, etc.

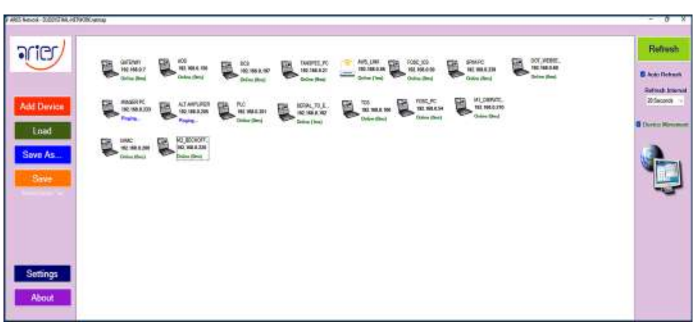


*Figure 101.* A screenshot of the network monitoring software.

## 7. Renovation of Telephone Exchange Room at Devasthal Base Camp (with upgraded systems)

Installation & commissioning of one IP-PBX at Devasthal base camp was completed, and the entire networking for all 4 Telephone exchanges (2 at Devasthal & 2 at Manora Peak campuses) was done for seamless integration and connectivity.

**8.** To facilitate cutting-edge research leveraging Artificial Intelligence (AI) and Machine Learning (ML) technologies, a high-end centralised GPU workstation was procured. The system is currently undergoing initial set-up and testing, and will soon be made accessible to users to support and accelerate their research work.

**9.** The ariesConnect Mobile Application was upgraded significantly with the introduction of enhanced features aimed at improving user experience, accessibility, and institutional connectivity.

## 10. "Surya" HPC Interfaces

The team supports and maintains centralised large-scale computing systems established to handle complex scientific and engineering computational loads. User accounts in the high-end "Surya" HPC facility and in the GPU workstation were increased significantly. 8 peer-reviewed publications have been reported that utilise the HPC facility in their computations. As a part of infrastructure development & maintenance activities, 2x20KVA Modular UPS system and 2x5 Tr Precision Air conditioners (PAC) units installed for running the Surya HPC facility were also maintained.

## 11. Network Security

To ensure network security, the team monitors network activity and implements strategies that prevent unauthorised access to the institute's data and information. Knowledge sharing and awareness regarding cyber threats and cybersecurity were carried out among users continuously. “Cyber Jagrookta Diwas” was celebrated on the first Wednesday of every month.

## 12. Connecting users with specialised softwares

Software licensing processes for the users were simplified. This enabled users to have fewer barriers in accessing useful software tools like Adobe CC, Microsoft Office, IDL, MATLAB, Ansys, OriginPro, SigmaPlot, Mathematica, LightField, LabView, AutoCAD, etc.

## 13. Enhanced security through IP-based CCTV

The Computer Section also manages a network of 93 IP-based night-vision and outdoor CCTVs (bullet and dome), which play a crucial role in surveillance and security of ARIES campuses.

Academic Programs at ARIES

The Academic Committee (AC) is committed to fostering a vibrant academic environment at ARIES by managing the academic affairs of both research scholars and short-term project students. The present members of the committee are listed below:

1. Dr. Yogesh C. Joshi (Chair)
2. Dr. Kuntal Misra (Co-Chair)
3. Dr. Saurabh
4. Dr. Krishna Prasad
5. Dr. Suvendu Rakshit
6. Dr. Priyanka Srivastav

## Major activities of the academic committee are:

### Joint Entrance Screening Test (JEST)

ARIES is one of the 33 participating institutions in the Joint Entrance Screening Test (JEST), which is held once a year. JEST serves as a national eligibility test for the PhD/Integrated PhD programs in Physics, Theoretical Computer Science, Neuroscience, or Computational Biology and is recognised by the Science and Engineering Research Board (SERB). The exam is coordinated on a rotational basis by the participating institutes. The Academic Committee plays an active role in the planning and organisation of the JEST exam, with the exam centres identified by ARIES and agreed upon by the host institute. Highly ranked students are offered to participate in the interview for selection as PhD students at ARIES.

### PhD Student Selection

The AC organises interviews each year to select PhD students at ARIES. AC members review applications and conduct interviews between May and June. Candidates with a master's degree in Physics/Astrophysics/Environmental Sciences and having eligible JEST, NET, or GATE score are invited for the interview. INSPIRE-qualified students fulfilling the required criteria are also considered. Successful candidates are selected as Junior Research Fellows (JRFs) and undergo a one-year pre-PhD coursework, followed by four years of research under the guidance of a scientist at ARIES. After two years, the AC conducts a comprehensive review of each student's performance, and accordingly, the student is promoted as Senior Research Fellow (SRF). Typically, the selected students are given the fellowship for five years to complete their PhD. For the academic year 2024-25, interviews took place during 16-18 May, 2024, and the following seven candidates joined as JRFs.

1. Mr. Shubham Yadav
2. Mr. Soumyadip Mandal
3. Ms. Ankita Khanra
4. Ms. Preeti
5. Mr. Hitesh Paliwal
6. Ms. Mansi
7. Mr. Pankaj Panwar

### Integrated MTech-PhD (Tech.) Programme

ARIES offers an Integrated MTech-PhD (Tech.) Programme in Astronomical Instrumentation, in collaboration with the Department of Applied Optics and Photonics, University of Calcutta (CU). The degree is awarded by CU. The MTech coursework lasts for two years and is divided into four semesters. After completing the MTech, students can opt to register for the PhD (Tech.) Program, subject to selection and meeting the minimum grade requirements. Eligible applicants include those with a three-year BTech degree (Post-BSc Hons) in Optics and Optoelectronics/ Radio Physics and Electronics from CU, or a Btech/BE degree in Electrical /Instrumentation/Electronics and Communications/ Computer Science/Mechanical Engineering from an AICTE-recognized institution, as well as candidates with an MSc in Physics/Electronic Science/Applied Mathematics/Applied Physics from a UGC-recognized institution. In the academic year 2024-25, the following two students joined the programme:

1. Mr. Mahender Shah
2. Ms. Suchandra Ray

## Visiting Student Programme of ARIES (VSPA)

One of AC's key initiatives is the Visiting Student Programme of ARIES (VSPA), which promotes interest in science and engineering among students from various institutions. Selected students work on specific projects under the supervision of ARIES scientists and engineers. This Program runs throughout the academic year and offers both short- and long-term training opportunities for Bachelor's and Master's level students. ARIES provides local hospitality to students selected for the Program every month. Additionally, ARIES hosts a summer internship Program for students selected by the Indian Academy of Science (IASc), offering a stipend of ₹25,000 for 8 weeks. The institute also participates in the National Initiative on Undergraduate Science (NIUS) Program, where undergraduate students are mentored by ARIES faculty during their project term. A total of 52 students completed short-term projects at ARIES during 2024-2025.

## ARIES Training School in Observational Astronomy (ATSOA)

ARIES organises the ARIES Training School in Observational Astronomy every summer. The school offers lectures on topics such as telescopes, star formation and evolution, galactic and extragalactic astronomy and various topics of atmospheric sciences. It is primarily targeted at students in their first or second year of MSc (Physics/Astrophysics), fourth or fifth year of Integrated MS (Physics), or fourth year of B.Tech (Engineering Physics) who are interested in observational astronomy. Around 30-40 students from various institutions across India participate in the Program each year. The school includes discussions and interactions with ARIES faculty, PhD students, and Post-Doctoral Fellows, as well as hands-on practice sessions on astronomical and atmospheric science data processing. Participants also visit ARIES observing facilities, including a live demonstration of ST Radar balloon flight and a one-day trip to the Devasthal Observatory to familiarise themselves with one of India's largest astronomical facilities. In the year 2024, a total of 35 students participated in the two-week-long ATSOA Program from 22 April to 3 May, 2024 and completed the short-term projects.

***Figure 102.*** *Group photo of ATSOA-2024 participants with ARIES faculty and research scholars.*

## Ph.D. Student Reviews

The AC organises reviews for first-year Ph.D. students upon completion of their coursework. In August 2024, the AC conducted examinations and project presentations for the first-year students. The AC also facilitated reviews for senior research students, including those promoted from Junior Research Fellow (JRF) to Senior Research Fellow (SRF).

## Ph.D. Thesis

Nine students from ARIES were awarded/defended their Ph.D. degrees during 2024-25.

**Akanksha Rajput** defended her Ph.D. degree in May 2024. Her thesis titled "Lower Atmospheric Studies Using ARIES Stratospheric Tropospheric (ST) Radar in Conjunction with In-situ and Auxiliary Observations" was submitted to the Deen Dayal Upadhyaya Gorakhpur University, Gorakhpur. She carried out this work under the **Dr. Narendra Singh** & Prof. Ravi Shankar Singh.

**Arpit Kumar Shrivastav** defended his Ph.D. degree in December 2024. His thesis titled "Observational Study of Decayless Waves Across Different Scales in the Solar Corona" was submitted to the Indian institute of science Benguluru. He carried out his work under **Prof. Dipankar Banerjee**, Dr. Piyali Chatterjee and Prof. Prateek Sharma.

**Arvind Kumar Dattatrey** defended his Ph.D. dgreee in June 2024. His thesis titled "Probing the census of hot stars in Globular Clusters" was submitted to the Deen Dayal Upadhyaya Gorakhpur University, Gorakhpur. He carried out his work under **Dr . Ramakant S. Yadav** & Prof. Ravi Shankar Singh.

**Bhavya** defended his Ph.D. dgreee in October 2024. Her thesis titled "Probing the harbingers of exotic astrophysical transients" was submitted to the Deen Dayal Upadhyaya Gorakhpur University, Gorakhpur. She carried out his work under **Dr. Kuntal Mishra**.

**Gurpreet Singh** defended his Ph.D. dgreee in October 2024 his thesis titled "Activity cycles and flares on solar-type stars" was submitted to the Deen Dayal Upadhyaya Gorakhpur University, Gorakhpur. He carried out his work under **Dr Jeewan Chandra Pandey**.

**Mahendar C. Rajwar** defended his Ph.D. degree in August 2024. His thesis titled "Studies of Non-Methane Hydrocarbons (NMHCs) in Ambient Air over the Central Himalayan and Associated Regions" was submitted to the Deen Dayal Upadhyaya Gorakhpur University, Gorakhpur . He carried out this work under **Dr. Manish Naja** & Prof. Rakesh Kumar Tiwari.

**Rahul** defended his Ph.D. dgreee in December 2024. His thesis titled "Source apportionment of carbonaceous aerosols in contrasting pollutant environment in India" was submitted to the Deen Dayal Upadhyaya Gorakhpur University, Gorakhpur. He carried out his work under **Dr. Umesh Chandra Dumka** and Prof. Rakesh Kumar Tiwari.

**Shubham Kishore** defended his Ph.D. dgreee in August 2024. His thesis titled "Optical studies of blazars with TESS satellite" was submitted to the Deen Dayal Upadhyaya Gorakhpur University, Gorakhpur. He carried out his work under **Dr Alok C. Gupta** & Prof. Sugriva Nath Tiwari.

**Tushar Tripathi** defended his Ph.D. degree in August 2024. His thesis titled "Multi-Band optical variability of Peculiar Blazars: BL Lacertae and S5 0716+714" was submitted to the Deen Dayal Upadhyaya Gorakhpur University, Gorakhpur. He carried out his work under **Dr. Alok C. Gupta** & Prof. Shantanu Rastogi.

## M.Tech. Degrees

Following two students from ARIES were awarded MTech degrees during 2024-2025.

**Arjun Dawn** defended his M.Tech. in July 2024 his thesis titled "Devasthal's Sky Model (DSM) and Exposure Time Calculator for DOT- HRS" was submitted to the University of Calcutta. He Carried out his work under **Dr. Jeewan Chandra Pandey**.

**Sarvesh Kumar Yadav** defended his M.Tech. thesis in July 2024. His thesis titled "A novel approach for transient detection and classification in astronomical surveys" was submitted to the University of Calcutta. He Carried out his work under **Dr. Kuntal Misra**.

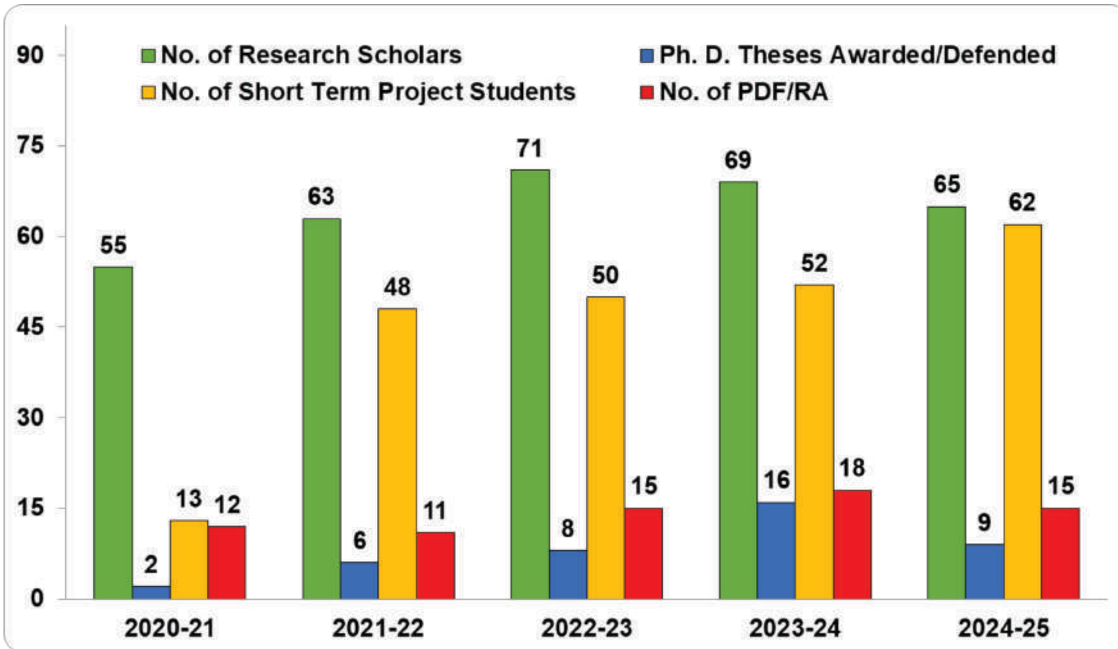



***Figure 103.*** *Human resource development by ARIES during the last 5 years.*

## Talks/Poster presentation delivered by research scholars and PDFs

### Aayushi Verma

- *Investigating the Star-forming Sites in the Outer Galactic Arm,* 15 – 19 February, 2025, 43rd annual meeting of The Astronomical Society of India, National Institute of Technology Rourkela. *(talk)*

### Amit Kumar

- *Exploring Origin of Ultra-Long Gamma-ray Bursts: Lessons from GRB 221009A,* 15 – 19 February, 2025, 43rd annual meeting of The Astronomical Society of India, National Institute of Technology Rourkela. *(poster)*

### Arpan Krishna Mitra

- *Spinning Black Holes in fluid,* 13 – 14 December, 2024, 3rd Hradec Králové International Physics Days. *(Invited talk)*

- *Barrow Holographic Dark Energy in Brane World Cosmology,* 15 – 19 February, 2025, 43rd annual meeting of The Astronomical Society of India, National Institute of Technology Rourkela. *(poster)*

- *Pion generation through p-p interaction and subsequent gamma ray production in accretion disc around a rotating BH,* 10 – 12 March, 2025, RETCO-VI : Theory and Observation 2025, IIT Indore. *(oral presentation)*

### Athul Dileep

- Ground and Space based Investigation of Intermediate age Open Star Cluster NGC 2126, 15 - 19 July, 2024, 8th TESS/15th Kepler Asteroseismic Science Consortium Workshop, Porto, Portugal. *(poster)*

- 21 – 26 July, 2024, Porto Summer School on Asteroseismology: From Pixels to Stellar Ages. *(participant)*

## Bhavya

- *Early flash ionisation signatures in type IIP SNe,* 11 - 12 March, 2025, Indo-Japan Workshop on Extreme Plasma Phenomenon in Universe, ARIES, Naintial. *(talk)*

## Devanand P U

- *X-Ray Spectral Variability of Thirteen TeV High Energy Peaked Blazars with XMM-Newton,* 15 – 19 February, 2025, 43rd annual meeting of The Astronomical Society of India, National Institute of Technology Rourkela. *(talk)*

## Dibya Kirti Mishra

- *Long term variation of solar features,* 21 - 30 May, 2024, 7th Aditya-L1 Support Cell workshop. *(talk)*
- *Estimation of Polar Magnetic Fields using Ca II K Polar Network as a Proxy,* 6 - 15 August, 2024, IAUG, 2024 Cape Town, South Africa. *(poster)*
- *Ca II K Polar Network as A Proxy for the Estimation of Historical Polar Magnetic Field of the Sun,* 1 - 4 October, 2024, Joint Symposium of Space Climate 9 Symposium, Nagoya University, Nagoya, Japan. *(talk)*
- *Ca II K Polar Network as A Proxy for the Estimation of Historical Polar Magnetic Field of the Sun,* 5 - 9 October 2024, 3rd Indian Spcae Weather Conference, IIT Roorkee. *(talk)*
- *Ca II K Polar Network as a Proxy to Estimate the Polar Field in the Sun,* 14 - 18 October 2024, Solar cycle variability: From understanding to making prediction, ARIES, Nainital. *(talk)*
- *Automated Detection of Plages in Hand-drawn Suncharts from the Kodaikanal Solar Observatory Using Machine Learning Technique,* 20 - 24 January 2025, Sun, Space Weather, and Solar-Stellar Connection IIA, Bengaluru. *(poster)*
- *Automatic Detection of Plages using Hand-drawn Suncharts from Kodaikanal Solar Observatory Employing Machine Learning Technique,* 15 – 19 February, 2025, 43rd annual meeting of The Astronomical Society of India, National Institute of Technology Rourkela. *(talk)*

## Gurpreet Singh

- *Shadow Maps: Imaging the far side of stellar coronae,* 14 – 15 September, 2024, 2nd Himalyan Meet of Astronomers (HMA), CUHP, Himachal Pradesh. *(talk)*
- *X-ray flares of solar-type stars,* 11 - 12 March, 2025, Indo-Japan Workshop on Extreme Plasma Phenomenon in Universe, ARIES, Naintial. *(talk)*

## Jincen Jose

- *The spectropolarimetric view of gamma ray emitting narrow line seyfert 1 galaxy,* 14 – 15 September, 2024, 2nd Himalyan Meet of Astronomers (HMA), CUHP, Himachal Pradesh. *(talk)*

## Jyoti Sheoran

- *Thermodynamic Evolution of Coronal Mass Ejections in the Inner Corona,* 5 - 10 May, 2024, "IAU Symposium, Krakow, Poland. *(poster)*
- *The Thermodynamic Evolution and Turbulence in Coronal Mass Ejections,* 25 July, 2024, Department of Physics, IIT Kanpur. *(invited talk)*

- *Investigating the turbulent properties of Interplanetary Coronal Mass Ejections,* 5 - 9 October, 2024, 3rd Indian Spcae Weather Conference, IIT Roorkee. (talk)

### Karan Dogra

- *Multiband optical variability of blazar 3C 454.3 on diverse time scales,* 22 - 26 July, 2024, Conference on Blazars and Restless AGN: A High Energy View, Presidency University, Kolkata. *(talk)*

### Kartik Gokhe

- 10 - 29 November 2024, Gravitational-Wave Instrumentation Winter Workshop, IUCAA, Pune. *(participant)*

### Khushboo Sharma

- 10 - 15 December, 2024, Manipal Astrostatistics School (MASS-2024), MCNS, MAHE, Manipal. *(participant)*

- *Prompt Emission Phase in Gamma-Ray Bursts,* 11 - 12 March, 2025, Indo-Japan Workshop on Extreme Plasma Phenomenon in Universe, ARIES, Naintial. *(talk)*

### Mahendar Rajwar

- *Spatiotemporal variations (2017-2022) in non-methane hydrocarbons in the central Himalayas and foothills regions: role in ozone formation and health risk*, 21–24 May, 2024, 52nd Global Monitoring Annual Conference, Boulder. *(talk)*

- *Unravelling ozone formation regimes in the Himalayan and IGP regions: a satellite-based study*, 22 to 25 October, 2024, URSI-RCRS 2024, GEHU, Bhimtal. *(talk)*

- *Studies of non-methane hydrocarbons (NMHCs) in ambient air over the central Himalayan and associated regions*, 1 October, 2024, Global Atmospheric Chemistry Laboratory, NIES, Japan. *(talk)*

- *Unravelling the role of non-methane hydrocarbons (NMHCs) in ozone, secondary aerosol formation and health risks in northern India: insights from a wintertime mobile campaign*, 12-13 March, 2025, International workshop on air pollution in northwestern India and future perspectives, IIT Delhi. *(talk)*

- *Role of non-methane hydrocarbons (nmhcs) in ozone formation*, 25 March, 2025, ECR Seminar, IGAC-iCACGP ECR SSC, NIES, Japan. *(talk)*

### Monalisa Dubey

- *Unravelling the Progenitor's Properties of Long-plateau Supernovae,* 11 - 12 March, 2025, Indo-Japan Workshop on Extreme Plasma Phenomenon in Universe, ARIES, Naintial. *(talk)*

### Mrinmoy Sarkar

- *Asteroseismology of delta scuti star HD 118660: TESS phototmetry and Modelling,* 15 – 19 February, 2025, 43rd annual meeting of The Astronomical Society of India, National Institute of Technology Rourkela. *(poster)*

### Mukesh Kumar

- *Investigation of ozone downward transport events over the central Himalayas: insights from ozonesonde and remote sensing data,* 22 - 25 October, 2024, URSI-RCRS 2024, GEHU, Bhimtal. *(talk)*

## Prakhar Singh

- 5 - 7 October, 2024, 2nd Workshop on Space Weather Science and Opportunities, IIT Roorkee. *(participant)*
- *Energetic and Kinematic Properties of Recurrent Solar Active Region Jets: Multi-Wavelength Analysis with AIA and IRIS Observations,* 20 - 24 January, 2025, Sun, Space Weather and Solar-Stellar Connections, IIA, Bangalore. *(poster)*
- 24 - 26 March, 2025, 9th Aditya-L1 Support cell Workshop, IIT Guwahati. *(participant)*

## Priyesh Kumar Tripathi

- *Isolated black holes accreting through dense environments,* 15 – 19 February, 2025, 43rd annual meeting of The Astronomical Society of India, National Institute of Technology Rourkela. *(talk)*
- *Disk Formation around Black Holes via Stream Accretion,* 10 – 12 March, 2025, RETCO-VI : Theory and Observation 2025, IIT Indore. *(talk)*
- *Disk Formation around Black Holes via Stream Accretion,* 18 – 21 March, 2025, YAM 2025, TIFR, Mumbai. *(talk)*

## Sanjit Debnath

- *Numerical simulations of variable accretion flows onto non-rotating black hole,* 14 - 15 September, 2024, 2nd Himalyan Meet of Astronomers (HMA), CUHP, Himachal Pradesh. *(talk)*
- *Oscillating Advective Viscous Accretion Disk: Dynamical Properties from the simulations,* 10 - 12 March, 2025, RETCO-VI : Theory and Observation 2025, IIT Indore. *(talk)*

## Sanmoy Bandyopadhyay

- *Solar Filaments Detection using Active Contours Without Edges,* 22 - 25 October, 2024, URSI-RCRS 2024, GEHU-Bhimtal. *(talk)*
- *Integral Adaptive Thresholding Inspired Solar Filament Detection,* 15 – 19 February, 2025, 43rd annual meeting of The Astronomical Society of India, National Institute of Technology Rourkela. *(talk)*
- *Unraveling Solar Fuzziness: Harnessing AI and ML Techniques for Big Solar Image Data Analysis,* 7 March, 2025, Department of Computer Science and Engineering, Indian Institute of Information Technology (IIIT), Nagpur. *(invited talk)*

## Shubham Kishore

- *Recent comprehensions on mid-November 2021, violent optical flare in OJ 287,* 14 - 15 September, 2024, 2nd Himalyan Meet of Astronomers (HMA), CUHP, Himachal Pradesh. *(talk)*

## Samrat Ghosh

- *Dynamic Photometric Variability in Three Young Brown Dwarfs in Taurus: Detection of Optical Flares with TESS data,* 15 – 19 February, 2025, 43rd annual meeting of The Astronomical Society of India, National Institute of Technology Rourkela. *(talk)*

### Tushar Tripathi

- *Optical Variability of blazar S5 0716+714 on diverse timescale,* 14 - 15 September, 2024, 2nd Himalyan Meet of Astronomers (HMA), CUHP, Himachal Pradesh. *(talk)*

### Upasna Baweja

- *Investigation of simultaneous longitudinal and transverse oscillations in polar plumes using Solar Orbiter,* 13 - 21 July, 2024, COSPAR Scientific Assembly: Korea AeroSpace Administration. *(talk)*
- *Global coronal magnetic field estimation using Bayesian Inference*, 5 - 9 October 2024, 3rd Indian Spcae Weather Conference, IIT Roorkee. *(talk)*
- *Investigation of Co-existence of longitudinal and transverse oscillations in the coronal plumes using Solar Orbiter,* 11 - 15 November, 2024, The 6th Asia Pacific Solar Physics Meeting: National Space Science Center, Chinese Academy of Sciences. *(talk)*
- *Investigation of Co-existence of longitudinal and transverse waves in polar plumes,* 15 – 19 February, 2025, 43rd annual meeting of The Astronomical Society of India, National Institute of Technology Rourkela. *(talk)*

### Vikas Rawat

- *Exploring aerosol dynamics in Central Himalaya during north indian biomass burning event-2022,* 7 - 12 July, 2024, IGARSS-2024. *(talk)*

### Vikrant Tomar

*Decadal variabilities in the tropospheric ozone over the central Himalayas and major urban centers in India*, 9 - 13 September, 2024, iCACGP-IGAC Conference 2024, Kuala Lumpur, Malaysia. *(poster)*

*Long term changes in air pollutants at urban regions of India using remote sensing data*, 21 - 25 October, 2024, URSI-RCRS, GEHU Bhimtal. *(talk)*

*The persistent burden of air pollutants: a long-term trend analysis over major India's metropolises*, 20 - 23 December, 2024, IASTA, DOON University, Dehradun. *(talk)*

*Decadal shifts in surface ozone trends at a central Himalayan site: revealing contrasting phases from 2007 to 2022*, 27 April - 2 May, 2025, PICO, EGU General Assembly 2025.

## List of Post Doctoral Fellows/Research Associates (15)

Abhijit Roy *(till 28-12-24)*
Balveer Singh *(till 18-07-24)*
Gulafsha B Choudhry
Krishna Mohana *(till 14-10-24)*
Sharmila Rani *(till 10-01-25)*
Amar Deo Chandra
Bharati Paul
Harmeen Kaur
Sandeep Kumar Mondal
Shishir Kumar Singh
Arpan K Mitra
Divya Pandey *(till 16-09-24)*
Km Nitu Rai
Samrat Ghosh
Subhajit Debnath

## List of Research Scholars (58)

| | | |
|---|---|---|
| Aayushi Verma | Akhilesh Ray | Ambika Saxena |
| Amit Kumar Ror | Anik Mandal *(till 14-08-24)* | Ankita Khanra |
| Anshika Gupta | Archana Kumari | Arpit Shrivastav |
| Arvind Kumar Dattatrey | Ashutosh Tomar | Athul Dileep |
| Bablu Mandal | Bhavya | Debalina Kar |
| Devanand PU | Dhruv Jain | Divyanshu Janghel |
| Dibya Kirti Mishra | Gurpreet Singh | Hitesh Paliwal |
| Jatin Parashar *(till 08-07-24)* | Jincen Jose | Jyoti |
| Karan Dogra | Khusboo Sharma | Mahadev A V |
| Mahendra C. Rajwar | Mamta | Manojit Chakraborty |
| Mansi | Monalisa Dubey | Mrinmoy Sarkar |
| Mukesh Kumar | Naveen Dukiya | Nitin Vashishtha |
| Pawar Pankaj Delveersingh | Prakhar Singh | Preeti |
| Pritam Das | Priyesh Kumar Tripathi | Rahul |
| Rohan Bose | Rishi C. | Sanjit Debnath |
| Shivangi Pandey | Shubham Kishore | Shubham Yadav |
| Soumyadip Mandal | Srinivas M. Rao | Srinjana Routh |
| Sunil Kumar | Surath Chandra Ghosh | Tarak Chand |
| Tushar Tripathi *(till 31-07-24)* | Upasna Baweja | Vikas Rawat |
| Vikrant Tomar | | |

## List of Integrated M.Tech-Ph.D. (Tech.) (07)

| | | |
|---|---|---|
| Arjun Dawn | Kartik Ghanshyam Gokhe | Kumar Pranshu |
| Mahendra Shah | Sarvesh Kumar Yadav | Suchandra Ray |
| Tushar Gajanan Ubarhande | | |

# Knowledge Resource Centre (KRC)/ Library

Libraries play a vital role in the world's system of education and information storage and retrieval. They make available through books, journals, films, recordings and other media, knowledge that has been accumulated through the ages. They encourage and promote the process of learning and grasping knowledge. It serves as the foundation for innovation, research, and progress. ARIES Knowledge Resource Center, or KRC, is an invaluable asset for scientists, researchers, students, and anyone with a passion for unravelling the mysteries of nature. The KRC provides a wealth of resources that cater to a diverse range of interests and needs of ARIES members.

The KRC acquires books and journals mainly related to Astronomy & Astrophysics, Atmospheric Sciences and Engineering. Reference books are also acquired from time to time. It is facilitated with Wi-Fi connectivity. The KRC is a member of the National Knowledge Resource Consortium (NKRC).

The Government of India has approved One Nation One Subscription (ONOS) scheme to provide country-wide access to international high impact scholarly research articles and journal publications to students, faculty and researchers of all Higher Education Institutions managed by the central government and state governments and Research & Development Institutions of the central government. From 1 January, 2025, the subscription to journals at KRC is available through ONOS.

The KRC is also responsible for providing reports and statistics on the activities of the institute. The monthly, quarterly and annual reports along with the Key Performance Indicator (KPI) data are prepared and submitted to the DST and other stakeholders regularly. Other reports and information are prepared by KRC as and when required.

**KRC Resource Development**

During the period 2024–2025, the following information resources were added:

| | |
|---|---|
| Publications in refereed journals | : 138 |
| Theses awarded | : 09 |

The collection at the end of the period is

| | |
|---|---|
| Books | : 11,209 |
| Bound volumes of Journals | : 11,205 |

Apart from books and journals, other old material such as slides, charts, maps, diskettes, CD-ROMs, etc. are also preserved and archived in the KRC database. The user-friendly features of Online Catalogue are also available at Web-OPAC in the ARIES website. DSpace, an open source software is used for the digital repository of ARIES, where KRC preserves theses, scientific documents, academic reports, photographs of special events, newspaper clippings etc.

# ARIES Science Popularisation & Public Outreach Programme (ASPOP)

ARIES deeply believes in the motto "Science is for everyone". Hence, it is a moral responsibility of scientists that they communicate their science to the society-at-large. ARIES Science Popularization and Outreach Programme (ASPOP) has been designed to fulfil the institute's objective of disseminating scientific knowledge among young students and the general public, particularly in this remote hilly region, in a manner that they can understand.

ARIES Science Centre is equipped with dedicated telescopes, a mini planetarium, science exhibits, movies etc. for science communication and public outreach activities for visitors. A large telescope has been procured for initiating stargazing for the public from S. K. Joshi Science Centre at Devasthal campus. In addition, many activities were conducted outside ARIES such as in schools, colleges and other venues. Scientists and engineers gave many popular talks in online and offline mode on various platforms. Important findings of research works were communicated in the form of science stories with the DST Media Cell and the local press media. An MoU was signed with the Kumaon Mandal Vikas Nigam Ltd. (KMVN) to boost astro-tourism in and around Nainital. Social media was utilised for digital outreach. Highlights of the activities of the last year are given below.

***Figure 104.*** *Media interaction during the MoU signing between ARIES and KMVN.*

**National Space Day:** 23rd August was declared as the National Space Day by the Honourable Prime Minister marking the landmark achievement of the successful landing of the Vikram lander of the Chandrayaan-3 mission near the lunar south pole. The first National Space Day was celebrated in a grand manner by ARIES during 13-23 August, 2025 in nearby schools and colleges, with activities culminating on 23 August at ARIES. Scientists and engineers gave popular talks and interacted with students. Poster gallery viewing, sunspot demonstration, screening of National Space Day videos, poetry and on the spot quiz etc. were organised. Over 1200 students participated in these activities. ARIES scientists and engineers were also invited to deliver popular talks on other forums. A glimpse of these activities is given in **figure 105**. The celebration received wide coverage in local news media.

*Figure 105. Glimpses of the 1st National Space Day celebrations.*

**Teacher Training Program:** A Teacher Training Program (TTP) sponsored by the International Astronomical Union – Office of Astronomy for Education (IAU – OAE) India Centre was jointly organised by ARIES and 'STEM and Space' was conducted at ARIES during 25-27 November 2024. The workshop provided training to 20 middle and high school teachers from the north Indian region on astronomy concepts, resources, online tools and pedagogical strategies for improvement in teaching space and astronomy content in classrooms. Highlights from the workshop are shown in the **figure 106**.


*Figure 106. Group Photo of the IAU OAE Teacher Training Program.*

**National Science Day:** Popular and science talks were organised at ARIES on 28 February, 2025 to celebrate the National Science Day. Due to rains, the open days for the general public and school students were held on 2 and 4 March respectively. Sunspot viewing, tours of observational facilities, interactions with scientists, planetarium shows, stargazing etc. were conducted on the open days. A glimpse of these activities is given in **figure 107**.

***Figure 107.*** *Glimpses of the National Science Day activities.*

**Special Celestial Events:** Special celestial events are a great opportunity to conduct science outreach activities as they generate a lot of interest among the public. Two such events occurred last year – sighting of a bright comet which became visible to naked eyes from darker locations and the planetary parade. Visitors were informed about these during regular stargazing sessions at ARIES. A popular talk and stargazing programme on the planetary parade was conducted for the public at MB Govt. PG College, Haldwani on 12 February 2025 **(Figure 108)**. A popular article on the planetary parade was published in local print media in Nainital and the 'Quest' magazine brought out by the NGO Awahan working for science outreach in Odisha.

***Figure 108.*** *Stargazing programme on the planetary parade at MB Govt. PG College, Haldwani.*

**Souvenir Shop:** Gauging the public interest a souvenir shop was set up in the science centre as a new initiative. Merchandise such as t-shirts, keychains, badges, ceramic mugs etc. bearing ARIES logo and major facilities were made available for purchase at a no-profit no-loss basis.

**India International Science Festival:** ARIES participated with a stall in the DST pavilion in IISF 2024, Guwahati during 30 November – 3 December **(Figure 109 and 110)** during which more than 1000 students visited the stall and learned about the institute's contribution to astronomy and atmospheric sciences research in India. A curtain raiser programme for IISF was conducted at ARIES with students from schools and universities on 18 November. Such events help increase awareness about the institute and its activities among people in far-off cities.



*__Figure 109.__ Left: A flyer of the curtain raiser programme. Right: The ARIES stall in DST pavilion at IISF 2024 Expo.*


*__Figure 110.__ Left: Dr. S. Somanath, Chairman, ISRO visiting ARIES stall. Right: Prof. Abhay Karandikar, Secretary, DST at the ARIES stall.*

**Outreach during ASI Annual Meeting:** To create awareness among scientists and young students about ARIES facilities, an exhibition stall was put up at the 43rd annual meeting of the Astronomical Society of India (ASI) NIT Rourkela during 15-19 February, 2025. As part of ASI's Public Outreach and Education Committee (ASI-POEC), an ARIES scientist helped in conducting many public outreach activities for school students in and around Rourkela.

**Other Outreach Activities:** A large number of local and non-local schools and colleges, especially many rural and government schools, visited ARIES for educational tours. Stargazing sessions are carried out every evening from the science centre subject to clear weather. The outreach team also visited the nearby NCC camp for stargazing sessions for the cadets. Bright students under the Lodha Genius Programme of Ashoka University, Sonipat and meritorious students of Aryabhat Foundation, Bhopal visited ARIES for extended educational visits. The honourable Governor of Tripura Shri Indrasena Reddy Nallu visited ARIES on 4th May 2024 **(Figure 111)**. Many other VIPs also visited the institute throughout the year.

***Figure 111.*** *The honourable Governor of Tripura Shri Indrasena Reddy Nallu observing sunspots through a H-alpha telescope.*

Scientific meetings are an integral part of academia where scientists discuss their research and network. During 2024-25, ARIES organised the following conferences and workshops.

**1)** 7th Aditya-L1 Support Cell (AL1SC) workshop at ARIES (21-30 May, 2024).

**2)** 8th Aditya-L1 Support Cell (AL1SC) workshop at IIT Indore (27-29 September, 2024).

**3)** International workshop on Solar Cycle Variability: From understanding to making prediction at ARIES (14-18 October, 2024).

**4)** 6th URSI-Regional Conference on Radio Science (RCRS) at Graphic Era Hill University, Bhimtal (22-25 October, 2024).

**5)** Indian Aerosol Science and Technology Association (IASTA) Conference 2024 at the Doon University, Dehradun (17-20 December, 2024)

**6)** ARIES-NAOJ workshop at ARIES (26 February, 2025).

**7)** Indo-Japan workshop on Extreme Plasma Phenomena in the Universe at ARIES (11-12 March, 2025).

**8)** 1st Aditya-L1 Support Cell (AL1SC) Teacher Training workshop at HBCSE, Mumbai (3-5 March, 2025).

**9)** 9th Aditya-L1 Support Cell (AL1SC) workshop at IIT Guwahati (24-26 March, 2025).

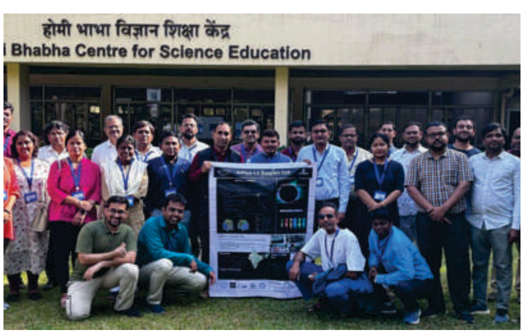
A highlight of these is presented below.

## AL1SC Workshops

The Aditya-L1 Support Cell (AL1SC)—a joint initiative of ISRO and ARIES—is actively engaged in capacity-building in solar physics and developing a research community through a series of specialized

*7th AL1SC workshop at ARIES.*

*8th AL1SC workshop at IIT Indore.*




*1st AL1SC teachers training workshop at HBCSE, Mumbai.*

*9th AL1SC workshop at IIT Guwahati.*

***Figure 112.*** *Glimpses of AL1SC workshops and teacher training workshop.*

training workshops across the country. The primary aim of these events is to equip students, young researchers, and educators with the knowledge and skills required to effectively use and analyze data from the Aditya-L1 mission. During the last year, four AL1SC workshops were conducted – the 7th AL1SC workshop at ARIES (21-30 May, 2024), the 8th AL1SC workshop at IIT Indore (27-29 September, 2024), the 1st AL1SC teacher training workshop at Homi Bhabha Centre for Science Education (HBCSE), Mumbai (3-5 March, 2025) and the 9th AL1SC workshop at IIT Guwahati (24-26 March, 2025). Nearly 100 MSc/ Int. MSc/ Int. PhD/ BTech/ MTech students and 30 teachers were trained in these workshops.

## Solar Cycle Variability: From understanding to making prediction during 14-18 October, 2024

An international meeting on "Solar cycle variability: From understanding to making prediction" was organized with the aim of bringing theoreticians, observers, modellers, and engineers from various subfields of solar and space physics. It provided a platform to discuss the progress in understanding the long-term variability of solar activity, share the different prediction methods for solar activity developed over the years, discuss the impact of solar activity on space weather, exchange different ideas on how to cross-calibrate data from different observations and utilize the data in various models to better understand and constrain the theoretical models. Over 70 researchers from India and abroad participated. It was supported in part by SCOSTEP/PRESTO and the Science and Engineering Research Board (SERB).

***Figure 113.*** *Participants of the Solar Cycle Variability meeting at ARIES.*

## 6th URSI-RCRS during 22-25 October, 2024

Radio science encompasses the knowledge and study of all aspects of electromagnetic fields and waves. The International Union of Radio Science (Union Radio-Scientifique Internationale or URSI), a non-governmental and non-profit organisation under the International Council for Science (ICS), stimulates and co-ordinates studies, research, applications, scientific exchange, and communication in the fields of radio science. The 6th edition of the Regional Conference on Radio Sciences of USRI (URSI-RCRS 2024) was jointly organised by ARIES and Graphic Era Hill University (GEHU) at the latter's Bhimtal campus. RCRS is a biennial flagship conference of the Indian Radio Science Society (InRaSS), a non-governmental and non-profit organization with a mission to disseminate radio science in India and neighbouring countries and foster excellence in the field. RCRS covers the broad research areas of URSI's 10 scientific commissions in radio sciences. About 400 researchers from across the country participated in the conference and presented their research findings in the fields ranging from meteorology, aeronomy, wave propagation in plasmas, space weather, astronomy, communication, instrumentation, bio medical applications etc. Two workshops on 'Ionospheric Measurement Techniques and Instrumentation' and 'Antenna Measurements' were also conducted on the first day of the conference.


***Figure 114.*** *Inauguration ceremony of the URSI-RCRS 2024.*


***Figure 115.*** *Dignitaries during the inauguration ceremony of the URSI-RCRS 2024.*


*Figure 116.* *Inauguration ceremony of the URSI-RCRS 2024.*

*Figure 117.* *Glimpses from the cultural programme during the URSI-RCRS 2024.*

## IASTA 2024 Conference during 17-20 December, 2024

The Indo-Gangetic plane is called the aerosol hotspot of the world. ARIES and Doon University, Dehradun jointly hosted the Indian Aerosol Science and Technology Association (IASTA) Conference 2024 at the Doon University campus to exchange scientific knowledge, recent research results and resources on aerosols in India. The theme of the conference was Aerosol Impacts to Air Quality, Human Health & Climate Change, with a participation of more than 250 researchers from across the country and abroad. As part of this conference, a panel discussion on Uttarakhand's degrading air quality with a focus on Doon valley and the intervention required was also organized.

***Figure 118.*** *Lamp lighting during the inaugural ceremony of IASTA 2024.*


***Figure 119.*** *Group photo of the participants of IASTA 2024.*

## ARIES-NAOJ workshop on 26 February, 2025

A half day workshop was organised by ARIES with the National Astronomical Observatory of Japan (NAOJ). It was aimed at initiating discussions on long term technical and scientific collaborations using the astronomical observatories in Japan and India, such as the 8 metre Subaru telescope and the 3.6m DOT.

***Figure 120.*** *Group photo of the ARIES-NAOJ workshop.*

## Indo-Japan workshop on Extreme Plasma Phenomena in the Universe during 11-12 March, 2025

The first Indo-Japan workshop on Extreme Plasma Phenomena in the Universe was organized at ARIES with an aim to build a platform to discuss multi-messenger astrophysics. The talks in the workshop covered the multi-messenger properties of transient objects such as supernovae and their remnants, cataclysmic variables, gamma-ray bursts, pulsars, pulsar wind nebulae, and outflow properties of cosmic rays, etc. The energetics of charged particles and their relativistic outflows play a crucial role in producing broadband emission in these objects and also help us to explore the Galactic origin of cosmic rays. There were a total of 22 participants in this workshop.

***Figure 121.*** *Group photo of the Indo-Japan workshop at ARIES.*

# ARIES Foundation Day

ARIES was founded on 22 March, 2004. To mark the occasion, a 4 day celebration programme was organised, which culminated on the foundation day. A blood donation drive was held on 19 March in association with Soban Singh Jeena Base Hospital, Haldwani & a local NGO 'Haldwani Online Sanstha'. A total of 44 ARIES members, including many first-timers, donated blood in the drive and contributed to the noble cause **(Figure 122)**.


***Figure 122.*** *Left: ARIES foundation day programme. Right: Blood donation drive at ARIES..*

This was followed by the ARIES In-house Meeting (AIM) 2025, a 2 day scientific-technical meeting of ARIES members, during 20-21 March, 2025. During the meeting, the scientists and engineers delivered talks focusing on the previous year's research and development activities undertaken by

***Figure 123.*** *Glimpses from ARIES In-house Meeting (AIM) 2025 and the cultural evening.*

their group. Discussions were held to identify the areas for improvement and chalk out the future path for the institute's activities and facilities. Cultural programmes were held on the evening of 21 March. Glimpses from the proceedings of the meeting and the cultural evening are shown in **figure 123**.

A public programme was organised on 22 March at Nainital Club. Beginning the proceedings of the day, Dr. Manish K. Naja, Director, ARIES welcomed the dignitaries and provided an overview of ARIES's history. Renowned eye surgeon Padma Shri Dr. J. S. Titiyal, formerly at AIIMS, New Delhi was the chief guest of the event. Prof. D. S. Rawat, Vice Chancellor, Kumaon University, Nainital was the guest of honour **(Figure 124)**. Dr. Titiyal delivered a public talk on "Eye Disorders, Prevention and Diagnosis". The Astronomy research at ARIES was summarised by Dr. Jeevan Pandey, Scientist and Chair of Astronomy Division, ARIES in his popular talk. A science quiz competition was conducted for school students. The programme ended with observation of sunspots safely through a telescope for the students and the public.

***Figure 124.*** *Glimpses from the public programme on the ARIES foundation day.*

The use of Hindi at ARIES has increased substantially in recent years. The objective of Rajbhasha division is that Hindi be used in all office works to the maximum extent possible. This is in line with the spirit of the Constitution. Needless to say, doing official work in the peoples' language speeds-up development and brings transparency in administration.

In the present era, it is essential for the development of any language to associate it with Information Technology. With the expansion of technology and its ever-increasing access to the people, it has become easier to increase the use of Hindi in almost all divisions of ARIES, even in some scientific and technical areas. The institute is working on necessary steps to get scientific and technical literature prepared in Hindi and make it available for the public. Many tools developed by the Rajbhasha Vibhag and other organisations have been used for typing, translation, reports, press releases etc. at the institute.

ARIES organised *Dwitiya Akhil Bhartiya Vaigyanik Evam Takniki Rajbhasha Sangoshthi* (Second All India Scientific & Technical Rahbhasha Conference) at Manora Peak, Nainital during 20-21 November, 2024. This conference was sponsored by DST. Scientists and engineers from all DST institutes presented their scientific work in Hindi for encouraging and spreading its usage in science outreach purposes. Rajbhasha Adhikari and senior administrative officers from DST and other AIs also attended the conference **(Figure 125)**.

***Figure 125.*** *Group photo of the "Dwitiya Akhil Bhartiya Vaigyanik Evam Takniki Rajbhasha Sangoshthi".*

The Department of Official Language organized the fourth All India Official Language Conference during 14-15 September, 2024 at Bharat Mandapam, New Delhi very successfully under the leadership of the Honourable Home and Cooperation Minister. Members from ARIES also participated in this event. Following this, *Hindi Pakhwada* was celebrated at ARIES during 17-30 September **(Figure 126)**. Multiple competitions were organised for the staff and students (in Hindi and Non-Hindi speaking categories) for encouraging usage of Hindi. Prizes were distributed during the closing ceremony on 30 September, 2024.

ARIES is a member of Nagar Rajbhasha Karyanvayan Samiti, NaRaKaS (Town Official Language Implementation Committee, TOLIC) Haldwani and received the second prize in November, 2024 for implementation of Hindi in office works during 2024-25 **(Figure 127)**. A total of 45 offices are registered under TOLIC Haldwani. The official language team and all other employees of the institute get inspiration and encouragement from such accolades.

ARIES members regularly participated in the activities carried out by TOLIC. The primary aim is to use Hindi in all the official works. Quarterly and annual reports were submitted to the ministry in a timely manner. All the government orders and annual programmes released by Rajbhasha Vibhag were followed properly at ARIES.

***Figure 126.*** *Prof. Dipankar Banerjee and Dr. Manish K. Naja lighting the lamp during Hindi Pakhwada celebration.*

***Figure 127.*** *Dr. Manish K. Naja, Director, ARIES and Mr. Mohit Joshi, Rajbhasha Adhikari receiving the second prize TOLIC Trophy.*

# Compliances and Staff Welfare

ARIES diligently follows compliance directives for important days and events. Several initiatives for the well-being of the employees and students have been taken such as medical and recreational facilities within the campus, awareness programmes, beautification of the campus etc. The institute has ensured a safe and equitable work environment devoid of any discrimination for all members, especially Nari Shakti, scheduled caste and tribes and Divyangs. Any grievances are addressed efficiently. Some of the measures are described below.

**International Day of Yoga:** IDY was celebrated on 21 June, 2024 with a Yoga session for everyone with a certified Yoga instructor. Participants were taught several Yogasanas along with their benefits.

***Figure 128.*** *Yoga session at ARIES on the occasion of IDY.*

**Plantation Drive:** To maintain the lush greenery of the campus, a plantation drive Ek Ped Maa Ke Naam by ARIES members was conducted on the occasion of Uttarakhand's local festival Harela in July, 2024.

***Figure 129.*** *Ek Ped Maa Ke Naam plantation drive at ARIES.*

**Cleanliness Drive:** Swachhta Pakhwada and Swachhta Hi Seva campaign were held during 14 September – 1 October, 2024 in which elaborate cleaning steps were undertaken around the Manora Peak as well as Devasthal campuses. ARIES members also participated in the cleaning efforts. Swachhta pledge was administered to the staff. On 27th September 2024, Shri A. S. Kiran Kumar, former Chairman, ISRO and Chairman, Governing Body, ARIES Shri Pradeep Kumar Singh, Director, Department of Science and Technology inspected participated in the cleaning campaign and also planted trees under Ek Ped Maa ke Naam. They gave the message of cleanliness in order to motivate people and increase public participation. Shri Pradeep along with ARIES members visited Gandhi Village Takula, Nainital which is a legacy of Mahatma Gandhi and administered the pledge to the students and the teachers in the Maharishi Vidya Mandir School, Takula.

*__Figure 130.__ (Left) Shri A. S. Kiran Kumar planting a sapling. (Right) Shri Pradeep Kumar Singh administering the Swachhta pledge to school students and teachers.*


*__Figure 131.__ Observation of Swachhta Pakhwada and Swachhta Hi Seva campaign at ARIES.*

**Vigilance Awareness Week:** The institute observed Vigilance Awareness Week during 28 October – 3 November, 2024 following the theme "Culture of Integrity for Nations's Prosperity". This initiative is one of the primary tools of preventive vigilance with the focus on building awareness and reaffirming the commitment of everyone to uphold integrity in public governance.

*__Figure 132.__ Dr. Brijesh Kumar, Vigilance Officer, ARIES administering the vigilance pledge to ARIES members.*

**75 years of the Indian Constitution:** The 75th anniversary of the adoption of the Constitution of India was celebrated with the theme *Humara Samvidhan, Humara Swabhimaan* by mass reading of the Preamble of the Constitution. A video on the Constitution was also screened for ARIES members.



***Figure 133.*** *Glimpses from the commemoration of 75 years of the Constitution of India at ARIES.*

**Right to Information (RTI) Cell:** CPIO and ACPIO are designated at ARIES and handle all the activities of RTI Cell efficiently. The objective of the RTI Act is to empower citizens to question the government. The act promotes transparency and accountability in the working of the government organisations. Right to Information Act 2005 mandates timely response to citizen requests for government information.

The Right to Information is governed by the Central Information Commission (CIC). A digital portal has been set up by the government, which acts as a gateway to the citizens for quick search of information on the details of first Appellate Authorities, PIOs etc. amongst others, besides access to RTI related information disclosures published on the web by various Public Authorities under the Government of India. The institute receives RTI applications through the online RTI portal as well as offline mode. Total 63 RTI requests were received during 2024-25 and all were disposed of.

The Act makes it obligatory for the institute to make suo motu disclosure in respect of the particulars of its organisation, functions, duties and other matters, as provided in section 3 of the Act. This information is available at ARIES website, according to sub-section (3) of section 3 and can be accessed easily. The requirements of section 3 are met and maximum information in respect of the institute is available on the website. It helps CPIO in two ways - first, the number of applications under the Act are reduced and secondly, it facilitates CPIO's work as most of the information is available at one place.

The suo motu disclosures are available on the website and updated in a timely manner. Self-appraisal of RTI disclosures was done and a third party audit by nominated authorities was completed.

The guidelines of RTI Act were followed properly, so that citizens could be benefited. Quarterly and annual reports were submitted to the ministry in a timely manner. All the government orders and annual programmes released by competent authorities were followed properly at ARIES.

**Medical Facility:** The institute has empanelled multiple hospitals at Haldwani for providing cashless treatment to all employees, their dependent family members and students on CGHS rates for both indoor as well as outdoor treatment. There is also a mechanism for the reimbursement of medical bills as per CGHS rates if the treatment is taken at outside these hospitals. A dispensary is available at Manora Peak campus which is equipped with first aid, generic medicines and commonly used medical instruments. Two doctors are engaged by ARIES, who visit the institute on a regular basis.

**Recreation:** The Manora Peak campus has a gymnasium and two badminton courts on the campus. The club house is equipped with facilities for table tennis and other indoor games. Volleyball and Cricket facilities are also available. ARIES Cricket Team participates in Cricket competitions in Nainital region from time to time. ARIES Staff Welfare Committee conducts an annual sports meet for all ARIES members and winners are awarded prizes in a cultural event held on Gandhi Jayanti.

***Figure 134.*** *Prize distribution for the Annual Sports Meet 2024.*

**Canteen:** The canteen is run on a no profit-no loss basis. Nutritious and hygienically prepared meals and snacks are available at subsidised rates. The institute also has a departmental store which serves employees and their family members residing in the campus.

**Group Insurance:** A Group Insurance Scheme is operational at ARIES in association with the Life Insurance Corporation of India. Employees of the institute are beneficiaries of the scheme.

**Reservation Policy:** The Institute follows all Government of India rules and norms in having the prescribed percentage of SC/ST/OBC reservations in all recruitments.

# Staff of ARIES

## Academic (24)

**Manish Kumar Naja**
***Director***
*(from 22-10-24)*

**Prof. Dipankar Banerjee**
***Director***
*(till 09-10-24)*

Alok C. Gupta

Brijesh Kumar

Govind Nandakumar
*(from 04-11-24)*

Haritma Gaur
*(Inspire Faculty Fellow)*

Indranil Chattopadhyay

Jagdish Chandra Joshi

Jeewan C. Pandey

Krishna P. Sayamanthula

Kuntal Misra

Narendra Singh

Neelam Panwar

Priyanka Srivastava

Ramakant Singh Yadav

Santosh Joshi

Shashi Bhushan Pandey

Saurabh

Sneh Lata

Suvendu Rakshit

Umesh C. Dumka

Vaibhav Pant

Virendra Yadav

Yogesh C. Joshi

## Engineering (12)


Ashish Kumar


B. Krishna Reddy


Chandra Prakash


Jayshreekar Pant


Mohit K. Joshi


Mukeshkumar B. Jaiswar


Nandish Nanjappa


Sanjit Sahu


Samaresh Bhattacharjee


Shobhit Yadava


Tarun Bangia


Tripurari S. Kumar

## Administrative and Support (12)


Rajneesh Mishra
*(Registrar)*


Bharat Singh
*(Asstt. Registrar)*


Abhishek Kr. Sharma


Amar Singh Meena


Basant Ballabh Bhatt


Hansa Karki


Himanshu Vidhyarthi


Manjay Yadav


Praveen Solanki


Rajeev Kumar Joshi


Ram Dayal Bhatt


Virendra Kumar Singh

## Scientific and Technical (27)


Abhijit Misra


Anant Ram Shukla


Arjun Singh


Ashok Kumar Singh
*(till 30-09-24)*


Babu Ram


C. Arjuna Reddy


Darwan Singh Negi


Harish Ch. Tewari *(till 31-01-25)*


Hemant Kumar


Imandi Sai Bhaskar


Javed Alam


Kanhaiya Prasad


Kanti Ram Maithani


Lalit Mohan Dalakoti


Manoj Kumar Mahto


Naveen Chandra Arya


Nitin Pal


Pavan Tiwari


Pooja Joshi *(till 22-08-24)*


Pradip Chakarborty


Rajdeep Singh


Rajendra Prasad


Ravindra Kumar Yadav


Sanjay Kumar Singh


Shyam Lal *(till 30-06-24)*


Srikant Yadav


Uday Singh

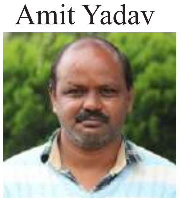
## MTS/Laboratory Assistant/Attendants (6)


Amit Yadav


Mohit Kumar


Pawan Joshi


Puran Singh Adhikari


Rakesh Kumar


Suresh Chandra Arya

New Members at ARIES (2024-25)

## Scientists

Dr. Govind Nandkumar
Scientist - C

Dr. Priyanka Srivastava
Scientist - C

## PDFs/Research Associates


Dr. Gulafsha B Choudhry

Dr. Harmeen Kaur

Km Nitu Rai

Dr. Sandeep Kumar Mondal

Dr. Subhajit Debnath

## Research Scholars

Ms. Ankita Khanra

Mr. Hitesh Paliwal

Ms. Mansi

Ms. Preeti

Mr. Shubham Yadav

Mr. Soumyadip Mandal

## Integrated M. Tech-Ph.D. Students

Mr. Mahendra Shah

Ms. Suchandra Ray

# Abbreviations

| | |
|---|---|
| A&A | Astronomy & Astrophysics |
| ADFOSC | ARIES Devasthal Faint Object Spectrograph & Camera |
| AGN | Active Galactic Nucleus |
| AGU | Auto-Guiding Unit |
| AI/ML | Artificial intelligence (AI) and Machine learning (ML) |
| AIA | Atmospheric Imaging Assembly |
| AL1SC | Aditya-L1 Support Cell |
| ALMA | Atacama Large Millimeter/submillimeter Array |
| AMOS | Advanced Mechanical and Optical Systems |
| AMSR | Advanced Microwave Scanning Radiometer |
| ASI | Astronomical Society of India |
| ASI-POEC | Public Outreach and Education Committee of ASI |
| ASPOP | ARIES Science Popularisation and Outreach Programme |
| ASPSM | Asia Pacific Solar Physics Meeting |
| ASTRAD | ARIES Stratosphere Troposphere Radar |
| ATSOA | ARIES Training School in Observational Astronomy |
| BEL | Bharat Electronics Limited |
| BHL | Bondi-Hoyle-Littleton |
| BLS | Broad-Line Seyfert |
| BMR | Bipolar Magnetic Region |
| BNS | Binary Neutron Stars |
| CAPE | Convective Available Potential Energy |
| CCD | Charge-Coupled Device |
| CGHS | Central Government Health Scheme |
| CIC | Central Information Commission |
| CIGALE | Code Investigating Galaxy Emission |
| CMOS | Complementary Metal-Oxide-Semiconductor |
| CNC | Computer Numerical Control |
| CNN | Convolutional Neural Network |
| CSM | Circumstellar Material |
| CUDA | Compute Unified Device Architecture |
| CWC | Continuous Wavelet Transform |
| DFOT | Devasthal Fast Optical Telescope |
| DOMU | DOT Operation, Maintenance and Upgradation |

| | |
|---|---|
| DOSPES | DOT Online Proposal Submission and Evaluation system |
| DOT | Devasthal Optical Telescope |
| DST | Department of Science & Technology |
| DTAC | DOT Time Allotment Committee |
| EMI | Electromagnetic Interference |
| EMSTO | Extended Main-Sequence Turn-Off |
| ESO | European Southern Observatory |
| ETGs | Early Type Galaxies |
| FBM | Fractional Brownian motion |
| FOSC | Faint Object Spectrograph and Camera |
| FPGA | Field-Programmable Gate Array |
| FWHM | Full Width at Half Maximum |
| GARCH | Generalized Autoregressive Conditional Heteroscedasticity |
| GEHU | Graphic Era Hill University |
| GHG | Greenhouse Gases |
| GOSAT-GW | Global Observing Satellite for Greenhouse Gases and Water Cycle |
| GRA | Graphical User Interface |
| GRB | Gamma Ray Bursts |
| GUI | Graphical Interface |
| HBCSE | Homi Bhabha Centre for Science Education |
| HCT | Himalayan Chandra Telescope |
| HFOSC | Himalayan Faint Object spectrograph Camera |
| HFS | Hub-Filament System |
| HMI | Helioseismic and Magnetic Imager |
| HPA | High-Power Amplifier |
| HPC | High-Performance Computing |
| HST | Hubble Space Telescope |
| HYSPLIT | Hybrid Single-Particle Lagrangian Integrated Trajectory |
| IAS | Indian Academy of Science |
| IASST | Institute of Advanced study in Science and Technology |
| IASTA | Indian Aerosol Science and Technology Association |
| IAU-OAE | International Astronomical Union-Office of Astronomy for Education |
| ICS | Indian Council of Science |
| IGP | Indo-Gangetic plain |

| | |
|---|---|
| ILMT | International Liquid Mirror Telescope |
| IMBH | Intermediate Mass Black Hole |
| INRASS | Indian Radio Science Society |
| INTEGRAL | International Gamma-Ray Astrophysics Laboratory |
| IPCC | Intergovernmental Panel on Climate Change |
| IR | Infrared |
| IRDE-DRDO | Instruments Research & Development Establishment- Defence Research & Development Organization |
| IRS | Indian Remote Sensing |
| ISM | Interstellar Medium |
| ISRO | Indian Space Research Organisation |
| ISSI | International Space Science Institute |
| IXPE | Imaging X-ray Polarimetry Explorer |
| JEST | Joint Entrance Screening Test |
| JRF | Junior Research Fellow |
| JWST | James Webb Space Telescope |
| KMVN | Kumaon Mandal Vikas Nigam |
| KPI | Key Performance Indicator |
| KRC | Knowledge Resource Centre |
| LBV | Luminous Blue Variable |
| LICT | Light Curve Inversion Technique |
| LMC | Large Magellanic Cloud |
| LST | Local Sidereal Time |
| LVK | LIGO-Virgo-KAGRA |
| MHD | Magneto Hydrodynamics |
| MMT | Multi-Mirror Telescope |
| MoU | Memorandum of Understanding |
| MRI | Meteorological Research Institute |
| MSF | Massive Star Formation |
| MSME | Micro, Small, and Medium Enterprises |
| NAOJ | National Astronomical Observatory of Japan |
| NaRakaS | Nagar Rajbhasha Karyanvayan Samiti |
| NASA | National Aeronautics and Space Administration |
| NGC | New General Catalogue |

| | |
|---|---|
| NGO | Non-Governmental Organization |
| NIR | Near-Infrared |
| NIUS | National Initiative on Undergraduate Sciences |
| NKRC | National Knowledge Resource Consortium |
| NLS | Narrow-Line Seyfert |
| NMSC | Nonmethane hydrocarbons |
| NSBH | Neutron Star – Black Hole |
| NSC | Nuclear Star Cluster |
| NUSTAR | Nuclear Spectroscopic Telescope Array |
| NWU | North West University |
| OFP | Ozone Formation Potential |
| PDR | Preliminary Design Review |
| PGC | Principal Galaxies Catalogue |
| PRL | Physical Research Laboratory |
| PWN | Pulsar Wind Nebulae |
| QPO | Quasi-Periodic Oscillation |
| RIHN | Research Institute of Humanity and Nature |
| RMS | Root Mean Square |
| SCADA | Supervisory Control and Data Acquisition |
| SCOSTEP/PRESTO | Scientific Committee on Solar Terrestrial Physics / Predictability of the variable Solar-Terrestrial Coupling |
| SDO | Solar Dynamics Observatory |
| SDSS | Sloan Digital Sky Survey |
| SED | Special Energy Distributions |
| SERB | Sciences and Engineering Research Board |
| SLCF | Short-Lived Climate Forcers |
| SMBH | Supermassive Black Hole |
| SMC | Small Magellanic Cloud |
| SN | Supernovae |
| SOAFP | Secondary Organic Aerosol Potential |
| SOP | Standard Operating Procedures |
| SPD | Surge Protection Device |
| SPIM | Side Port Imager |
| SRF | Senior Research Fellowship |

| | |
|---|---|
| SSA | Space Situational Awareness |
| SSR | Surface Solar Radiation |
| ST | Sampurnanand Telescope |
| SWJ | Subtropical Westerly Jet |
| TANSO | Total Anthropogenic and Natural emissions mapping Spectrometer |
| TANSPEC | TIFR-ARIES Near Infrared Spectrometer |
| TCS | Telescope Control System |
| TDE | Tidal Disruption Events |
| TDI | Time Delay Integration |
| TESS | Transiting Exponent Survey Satellite |
| TEV | Teraelectronvolt |
| TIFR | Tata Institute of Fundamental Research |
| TIG | Tungsten Inert Gas welding |
| TOLIC | Town Official Language Implementation Committee |
| TPOINT | Telescope Pointing Analysis System |
| TRM | Transmit Receive modules |
| TROPOMI | Tropospheric Monitoring Instrument |
| TTP | Teacher Training Program |
| TTV | Transit Timing Variations |
| UPS | Uninterruptible Power Supply |
| URSC | U. R. Rao Satellite Centre |
| URSI | Union Radio Scientifique Internationale |
| URSSI-RCRS | URSI Regional Conference on Radio Science |
| USA | United States of America |
| UV | Ultraviolet |
| VSCC | Vikram Sarabhai Space Centre |
| VSPA | Visiting Student Programme of ARIES |
| WD | Western Disturbances |
| WR | Wolf Rayet |
| WRF | Weather Research & Forecasting |
| WWZ | Weighted Wavelet Transform |
| XMM | X-ray Multi-Mirror Mission |
| YSO | Young Stellar Objects |
| ZCFI | Zero Carbon Freight Index |

# Audit Statements of Account 2024-2025

R S KAFALTIYA & ASSOCIATES

Chartered Accountants

FRN: 024191C

**INDEPENDENT AUDITOR'S REPORT**

**FINANCIAL YEAR – 2024-2025**

**UDIN: 25411796BMKOYJ5681**

**Dated: September 24, 2025**

To,

THE REGISTRAR,

ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES),

UNDER THE DEPARTMENT OF SCIENCE & TECHNOLOGY (DST),

GOVERNMENT OF INDIA, MANORA PEAK,

NAINITAL – 263139

UTTARAKHAND

**Report on the Audit of the Financial Statements**

**(1) Opinion:**

We have audited the accompanying Financial Statements of **"ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES), NAINITAL, ("The Institute") (PAN: AAAAA8701B),** which comprise the Balance sheet as at March 31, 2025, the statement of Income & Expenditure and the Statement of Receipt & Payment for the year then ended, and notes to the financial statements, including a summary of significant accounting policies.

In our opinion, and to the best of our information and according to the explanations given to us the accompanying financial statements, give the information required by the applicable Indian laws and regulations to the Institute in the manner so required and give a true and fair view in conformity with the accounting principles generally accepted in India, of the financial position of the Institute as at March 31, 2025 and its financial performances for the year then ended.

**(2) Basis for Opinion:**

We conducted our audit in accordance with the Standards on Auditing (SAs) issued by ICAI. Our responsibilities under those Standards are further described in the Auditor's Responsibilities for the Audit of the Financial Statements section of our report. We are independent of the Institute in accordance with the code of ethics issued by the Institute of Chartered Accountants of India (ICAI) together with the ethical requirements that are relevant to our audit of the financial statements and we have fulfilled our other ethical responsibilities in accordance with these requirements and the code of ethics. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion on the financial statements.

**(3) Key Audit Matters:**

Key Audit Matters are those matters that, in our professional judgment, were of most significance in our audit of the financial statements of the Institute for the year ended March 31, 2025. These matters were addressed in the context of our audit of the financial statements as a whole, and informing our opinion thereon, and we do not provide a separate opinion on these matters

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We have determined the matters described below to be the Key Audit Matters to be communicated in our report. We have fulfilled the responsibilities described in "Auditor's Responsibilities for the Audit of the Financial Statements" section of our report, including in relation to these matters

Accordingly, our audit included the performance of procedures designed to respond to our assessment of the risks of material misstatements of the financial statements. The results of our audit procedures, including the procedures performed to address the matters below, provide the basis for our audit opinion on the accompanying financial statements.

(a) **Deviation from Accrual System of Accounting:**

The financial statements have been prepared on a historical cost basis, unless otherwise stated, and generally on an accrual basis of accounting in accordance with ICAI Accounting Standards, and General Financial Rules (GFRs) 2017. However, certain transactions are recorded on a cash basis, as detailed below:

i. Transactions related to various recoveries out of the salary are recorded in the books of accounts on CASH basis as per management's decision.
ii. Transactions related to interest on advances to employees are recorded in the books of accounts on CASH basis as per management's decision.
iii. Transactions related to re-imbursement of telephone expenses to employees are recorded in the books of accounts on CASH basis as per management's decision.
iv. Transactions relating to TDS under the GST laws are recorded in the books of accounts on CASH basis as per management's decision.
v. Transactions related to Accrual Interest on all the Project Bank accounts (including Director ARIES account) are recorded in the books of accounts on CASH basis as per management's decision; and
vi. Transactions related to all legal expenses related to court cases are recorded in the books of accounts on CASH basis as per management's decision.

Further, it is observed that the Institute predominantly operates on a cash basis during the year, recording adjustment entries only at year-end, which are subsequently reversed. This practice deviates from the accrual system of accounting and may lead to distortion of financial results, understatement or overstatement of assets and liabilities, and affects the true and fair presentation of the financial statements

ARIES while accepting the audit observation stated (September 2025) that it has implemented accrual system of accounting for above mentioned transactions from 01-04-2025.

(b) **Non-Maintenance of Comprehensive Fixed Asset Register:**

During the course of audit, it was observed that the Institute has not maintained a comprehensive Property, Plant & Equipment (Fixed Asset) Register presenting head-wise, item-wise and year/date-wise details relating to cost, accumulated depreciation, and written down value of each asset. The register maintained by the Institute does not comply with the requirements of Rule 194 of the General Financial Rules, 2017 (GFRs),

R S KAFALTIYA & ASSOCIATES Chartered Accountants FRN:024191C HALDWANI which mandate that all organizations receiving Government grants must maintain an asset register with complete particulars of assets, including location and identification.

Verification of Property, Plant & Equipment was instead carried out through the schedule of assets generated from the accounting records maintained in the "Tally – ERP-9" software. While the schedule provides aggregate information, it does not serve the purpose of a statutory asset register with requisite details for control, accountability and disclosure.

(c) **Non-Provision for Arbitration Award – Contingent Liability under AS 29:**
A litigation was pending before the Arbitration Tribunal in respect of a legal claim filed by M/s Vidhyawati Construction Co. against the Institute. The said claim was decreed against the Institute during the Financial Year 2021-22, creating a liability of Rs.1,05,65,018/- plus interest as awarded by the Tribunal. The Institute has filed an appeal against the aforesaid order before the Commercial Court, Dehradun, which is presently pending adjudication.

The Institute has not created any provision in its books of account for the Financial Year 2024-25 in respect of the aforesaid liability. However, legal expenses of Rs.1,34,700/- incurred during the year on this matter have been charged to the Income & Expenditure Account.

In view of the pendency of the appeal, the liability is contingent upon the outcome of the case. Non-creation of provision for the decreed amount (Rs.1,05,65,018/- plus interest) is not in accordance with the requirements of Accounting Standard (AS) 29 – Provisions, Contingent Liabilities and Contingent Assets. Pending the decision of the appellate authority, we are unable to comment on the ultimate financial impact of the said liability on the accounts of the Institute.

(d) **Outstanding Income Tax Demands and Non-Rectification in Department Records:**
Orders issued by the Income Tax Department indicate that the income tax cases pertaining to Assessment Years 2016-17 and 2018-19 have been settled in favour of the Institute. However, as per the records available on the Income Tax Department's portal, certain outstanding demands continue to be reflected against the Institute, details of which are as under:

| Assessment Year | Demand Ref No | Amount (Rs.) | Interest accrued till 24-09-2025 |
|---|---|---|---|
| 2016-17 | 2018201637043232274T | 2,67,81,900 | 2,49,99,333 |
| 2018-19 | 2020201837025496342T | 7,43,02,340 | 4,18,76,271 |
| 2018-19 | 2020201837025496342T | 1,87,830 | 1,05,168 |
| Total | | 10,12,72,070 | 6,69,80,772 |

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Although the above cases have been decided in favour of the Institute, the continuing reflection of such demands on the Income Tax portal indicates that the necessary rectification/closure has not been effected in the Department's records. Necessary process for closure/rectification of such demands is yet to be initiated.

During the year under audit, the Income Tax Department has adjusted a sum of Rs.6,04,330/- against the income tax refund due to the Institute for the Financial Year 2023-24. The Department may further adjust future refunds towards such outstanding demands until the same are rectified/removed from the portal.

Further, the Institute had pre-deposited income tax of Rs.92,40,698/- pursuant to notices issued by the Income Tax authorities. Since the cases have now been settled in favour of the Institute, management is advised to take necessary steps with the Income Tax Department for refund of the aforesaid pre-deposit as well as amounts already adjusted.

In the absence of confirmation/rectification by the Income Tax Department, we are unable to comment upon the correctness and impact of such outstanding demands. Pending settlement, the possibility of adjustment of future refunds or creation of additional liability on the Institute cannot be ruled out.

ARIES while accepting the audit observation stated that the institute has initiated the process for removal of demands from income tax portal and recovery of deposited amount.

(e) **Non-Remittance of NPS Contributions Pending Legal Case:**
It was observed that statutory liability towards National Pension Scheme (NPS) amounting to Rs.18,98,728/- (comprising both Employer's and Employee's share) in respect of Shri Ravinder Kumar, Ex-Registrar has not been remitted to the NPS authorities up to 31st March 2025, owing to a pending legal case in this matter.

In the absence of remittance/clarification from the NPS authorities, we are unable to comment on the potential financial and legal impact that may devolve on the Institute. The said liability should either have been remitted or appropriately disclosed under current liabilities along with contingent liability note, pending disposal of the legal case.

(f) **Non-Reversal of Ineligible Input Tax Credit under GST:**
It has been observed that the Institute, being engaged predominantly in research-related activities, enjoys exemption under the GST Laws in terms of Notification No. 12/2017-Central Tax (Rate) dated 28.06.2017 (education/research-related services provided by an educational or research institution). As per the provisions of Section 17(2) of the CGST Act, 2017, read with Rule 42 of the CGST Rules, 2017, where goods or services are used partly for exempt supplies and partly for taxable supplies, the Institute is required to reverse proportionate Input Tax Credit (ITC) attributable to exempt supplies.

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During the course of audit, it was noted that GST Input Tax Credit amounting to Rs.20,36,500/- (CGST: Rs.49,890/-; SGST: Rs.19,86,610/-) has remained unutilized and unreversed for a considerable period. Non-reversal of such ineligible ITC not only contravenes the above provisions but also exposes the Institute to the risk of denial of credit, levy of interest under Section 50 of the CGST Act, 2017, and penalty under Section 73/74 of the CGST Act, 2017.

The management is advised to take immediate corrective steps to identify, compute, and reverse the ineligible ITC in accordance with the prescribed mechanism under Rule 42, and ensure accurate and timely reporting in GSTR-3B and annual return (GSTR-9) to avoid penal consequences.

(g) **Non-Charging and Non-Payment of GST on Scrap Sales**

It was observed that the Institute earned Rs.7,00,887 lakhs from scrap sales during the Financial Year 2024–25. However, Goods and Services Tax (GST) was neither charged nor discharged on these transactions. Further, the said turnover was not reported in GSTR-1 or GSTR-3B returns filed by the Institute.

As per Section 9 of the CGST Act, 2017, read with Schedule II and relevant GST notifications, the sale of scrap constitutes a taxable outward supply liable to GST. Failure to charge and pay GST on such transactions, as well as non-reporting in statutory returns, amounts to non-compliance with the CGST Act, 2017. This exposes the Institute to additional tax liability together with interest under Section 50 and penalty under Sections 73/74 of the CGST Act, 2017.

ARIES while accepting the audit observation stated that the institute has deposited GST of Rs 1,06,916 along with late fee of Rs. 21,366 on 15th September 2025 in respect of the scrap sales amounting to Rs. 7,00,887 made during the Financial Year 2024–25. This deposit has been made in compliance with our audit query regarding non-levy and non-payment of GST on such transactions..

(h) **Non-Recognition of Defined Benefit Obligations for Gratuity and Leave Encashment (AS 15 Non-Compliance)**

It was observed that the Institute is accounting for gratuity and leave encashment expenses only at the time of retirement of employees, instead of recognizing these as defined retirement benefit obligations on an actuarial basis. During the year, the Institute paid gratuity of Rs.82,07,733 and leave encashment of Rs.52,99,631 out of grants received from the Department of Science & Technology (DST). AS 15 (Revised) – Employee Benefits – Employee Benefits mandate recognition of gratuity and leave encashment as defined benefit plans. The present value of defined benefit obligations should be determined using the Projected Unit Credit Method with the assistance of an actuary. Liabilities should be recognized annually in the financial statements, not only at the time of retirement

The current practice of recognizing gratuity and leave encashment liabilities only on retirement is not in compliance with AS 15. This results in understatement of employee benefit liabilities and distortion of annual expenditure. The payments made out of DST

grants (Rs.82.08 lakhs gratuity and Rs.53.00 lakhs leave encashment) have been booked, but no actuarial liability has been recognized in the financial statements.

Pending actuarial valuation, we are unable to comment on the correctness and completeness of the liability towards gratuity and leave encashment as at 31st March 2025.

The Institute should carry out an actuarial valuation at each reporting date and recognize the present value of defined benefit obligations in accordance with AS 15. Alternatively, the Institute may subscribe to approved group gratuity, superannuation and leave encashment schemes of fund managers such as LIC to ensure compliance and proper provisioning.

(i) **Unreconciled Bank Balance Difference relating to Previous Years transferred to "Extraneous Debit" Account**

During the course of our audit, we noted that there is a difference of Rs.16, 62,316.20 between the balance as per bank statement and the closing balance as per books of account in the Savings Bank Account No. 10860840253 – SBI (Director) Bank Account. The said difference pertains to earlier financial years and has not yet been reconciled. Management has transferred this difference to a separate account titled "Extraneous Debit" (shown under Assets head) for parking such differences. Management has represented that efforts are being made to trace the reason for the difference and reconcile the balance at the earliest.

In our opinion, until such reconciliation is carried out and the underlying cause of the difference is identified, the balance of "Extraneous Debit" account cannot be considered as recoverable or correctly classified under assets. Accordingly, the financial statements may not reflect a true and fair view to the extent of the unresolved difference

(j) **Non-Payment of GST under Reverse Charge on Legal Services (Subsequently Complied)**

During the year under audit, the institute has incurred expenses on services which are chargeable to GST under the Reverse Charge Mechanism. However, GST is not paid by the institute on such services. Details of such services are as under:

| Sl.No | Name of service | Expenditure Amount (Rs.) |
|---|---|---|
| 1 | Legal Services by advocate | 7,76,250 |

Pursuant to our audit observation, the Institute deposited GST of Rs.1,39,724 along with late fee of Rs.19,482 on 15th September 2025 in respect of the legal services availed, thereby regularizing the default.

(k) **Accounting of Interest on Advances on Cash Basis instead of Accrual Basis:**

As per the accounting policy of the institute, recovery of advances including interest are recorded on cash basis. It is advisable to change policy to an accrual basis so as to record interest on advances applying the prescribed rates in the General Financial Rules as amended from time to time. For e.g., Interest rate on computer advance for the F.Y. 2024-25 is @ 9.1%.

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(l) **Non-Compliance with Deduction at Source (TDS) and Other Tax Laws:**
It is observed in the following instances that TDS was not deducted at the time of making payments to suppliers:

i. **Non-Deduction of TDS under Section 194Q on Purchase of Goods:**
Section 194Q mandates that any buyer whose turnover exceeds Rs.10 crore in the preceding financial year is required to deduct TDS at the rate of 0.1% on purchases of goods from a resident seller if the value of such purchases exceeds Rs. 50 lakh in a financial year. The Institute has paid Rs. 52,75,950 to M/s Rato Communication and Electronics Private Limited towards the purchase of SMPS power supply units with communication features. However, tax was not deducted at source (TDS) under section 194Q of the Income-tax Act at the time of payment.

ii. **Non-Deduction of TDS under Section 195 on Payment to Non-Resident**
The Institute paid an honorarium of Rs. 15,32,693 to Prof. Jean Surdej (Belgium Resident) on 31-12-2024 without deduction of tax at source @10%/20% as per Section 195. Further, liability for interest under Section 201 arises due to non-deduction

iii. **Non-Filing of Form 15CA/15CB in respect of Payments to Non-Residents**
As per Section 195 of the Income-tax Act, 1961, remittances made to non-residents are required to be reported in Form 15CA and, where applicable, certified through Form 15CB prior to payment. On examination, it was noted that the Institute had not complied with this requirement in various instances. These include a payment of Rs. 15,32,693 on 31st December 2024 to Prof. Jean Surdej towards honorarium, and payments aggregating to Rs. 6,75,295 towards library expenses to overseas entities such as the European Southern Observatory (Rs. 91,354 on 1st April 2024, Rs. 33,657 on 4th April 2024, and Rs. 17,404 on 13th August 2024), IOP Publishing Limited (Rs.3,51,289 on 5th June 2024), and GB Oxford University Press (Rs.1,81,591 on 13th August 2024). The absence of furnishing the prescribed Form 15CA/15CB in these cases constitutes non-compliance with statutory provisions.
On being apprised of the above non-compliances, ARIES has acknowledged the audit observation and informed that it has since initiated the practice of submitting Form 15CA/15CB, as applicable, prior to effecting remittances to non-residents.

(m) **Non-Utilization of Accumulated Funds under Section 11(2) of the Income-tax Act, 1961**
Provisions of Section 11 (2) of the income tax act,1961 (the Act) stipulates that *"Where eighty-five per cent of the income referred to in clause (a) or clause (b) of sub-section (1) read with the Explanation to that sub-section is not applied, or is not deemed to have been applied, to charitable or religious purposes in India during the previous year but is accumulated or set apart, either in whole or in part, for application to such purposes in India, such income so accumulated or set apart shall not be included in the*

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*total income of the previous year of the person in receipt of the income, provided the following conditions are complied with, namely-*

*a) such person furnishes a statement in the prescribed form and in the prescribed manner to the Assessing Officer, stating the purpose for which the income is being accumulated or set apart and the period for which the income is to be accumulated or set apart, which shall in no case exceed five years;*

*b) the money so accumulated or set apart is invested or deposited in the forms or modes specified in sub-section (5);*

*c) the statement referred to in clause (a) is furnished at least two months prior to the due date specified under sub-section (1) of* section 139 *for furnishing the return of income for the previous year*

***Provided** that in computing the period of five years referred to in clause (a), the period during which the income could not be applied for the purpose for which it is so accumulated or set apart, due to an order or injunction of any court, shall be excluded.*

Section 11(3) (b) of the Act further states that Any income referred to in sub-section (2) which-

a) ......

b) ......

c) is not utilised for the purpose for which it is so accumulated or set apart during the period referred to in clause (*a*) of that sub-section.

d) .......

*shall be deemed to be the income of such person of the previous year-*

*i.* .......

*ii.* .......

*iii.* *being the last previous year of the period, for which the income is accumulated or set apart but not utilised for the purpose for which it is so accumulated or set apart under clause (c)*

*iv.* .......

Income tax records of previous years, filed with the income tax department, reveals that the institute has accumulated or set apart a total amount of Rs. 6,50,02,953 and not utilized for the purpose for which such accumulations were made, till the date of balance sheet under audit. The institute has declared in the income tax returns that the amounts so accumulated are invested or deposited in the modes specified in section 11(5) of the Act. Details of such accumulations are as given below:

| Year | Amount (Rs.) | Reference | Accumulation period expiring on |
|---|---|---|---|
| 2020-21 | 2,48,28,000 | Form No-10 dated 03.12.2021 | 31-03-2026 |
| 2021-22 | 4,01,74,953 | Form No-10 dated 28.10.2022 | 31-03-2027 |

In this regard, management is advised to utilize above said accumulated and invested funds, supra, for the purpose for which it is accumulated on or before the time limit

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prescribed under section 11 (2) (a) of the Income Tax Act, 1961 otherwise the whole unutilized amount shall be deemed to be the income of the last year declared in respective Form 10.

(n) **Non-Intimation of Additional Place of Business/Activity to Income-tax Department under Section 12A/12AB**
During the course of audit, it was noted that Aryabhatta Research Institute of Observational Sciences (ARIES), Nainital, a society registered under section 12A/12AB of the Income-tax Act, 1961 and exempt under section 12 of the Act, has its registered office at Manora Peak, Nainital. The Institute has also established a second location at Devasthal, where significant expenditure has been incurred on infrastructure, telescope, and related scientific facilities. However, it has been observed that the Institute has not intimated the Income-tax Department regarding this additional place of business/activity. As per the requirements under the Income-tax Act, 1961, particularly section 12A(1)(b) read with Rule 17A of the Income-tax Rules, 1962, any change in the objects, rules, regulations, or the place of activity/business of a trust or institution registered under section 12A/12AB is required to be intimated to the Income-tax Department in the prescribed manner (Form 10A/10AB). Failure to comply with this requirement may expose the Institute to the risk that the Income-tax Department may not recognize the expenditure incurred at the unreported location (Devasthal) as application of income for charitable purposes, thereby potentially affecting the availability of exemption under section 11 of the Act.
We recommend that ARIES should immediately take necessary steps to file intimation in the prescribed form to safeguard its exemption status and to ensure that all expenditures incurred at Devasthal are duly considered as application of income for charitable purposes under the Income-tax Act.
Upon being apprised of the above non-compliance, ARIES promptly accepted the audit observation and has taken corrective action by submitting the prescribed intimation to the Income-tax Department, formally reporting Devasthal as an additional place of activity of the Institute.

**Our opinion is not modified in respect of these matters.**

**(4) <u>Responsibilities of Management for the Financial Statements</u>:**

The Institute's Management is responsible for the preparation and fair presentation of these financial statements that give a true and fair view of the financial position and financial performance of the Institute in accordance with the accounting principles generally accepted in India and the provisions of Rules & Regulation of the ARIES duly approved by Department of Science & Technology Government of India.

This responsibility also includes maintenance of adequate accounting records for safeguarding of the assets of the Institute and for preventing and detecting frauds and other irregularities; selection and application of appropriate accounting policies; making judgments and estimates that are reasonable and prudent; and design, implementation and maintenance

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of adequate internal financial controls, that were operating effectively for ensuring the accuracy and completeness of the accounting records, relevant to the preparation and presentation of the financial statements that give a true and fair view and are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, management is responsible for assessing the Institute's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless management either intends to liquidate the Institute or to cease operations, or has no realistic alternative but to do so.
The management is also responsible for overseeing the Institute's financial reporting process.

**(5) Auditor's Responsibilities for the Audit of the Financial Statements:**

Our objective is to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with SAs will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis f these financial statements.

As part of an audit in accordance with SAs, we exercise professional judgment and maintain professional skepticism throughout the audit.

We also:

- Identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.
- Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by management.
- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Institute's internal control.
- Conclude on the appropriateness of management's use of the going concern basis of accounting and based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Institute's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our

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auditor's report. However, future events or conditions may cause the Institute to cease to continue as a going concern.

- Evaluate the overall presentation, structure and control of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.

Materiality is the magnitude of misstatements of the financial statements that, individually or in aggregate, makes it probable that the economic decisions of the reasonably knowledgeable user of the financial statements may be influenced. We consider quantitative materiality and qualitative factors in (i) planning the scope of our audit work & evaluating the results of our work; and (ii) to evaluate the effect of any identified misstatements in the financial statements.

We communicate with those charged with governance regarding among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

We also provide those charged with governance with a statement that we have complied with relevant ethical requirements regarding independence, and to communicate with them all relationships and other matters that may reasonably be thought to bear on our independence and where applicable, related safeguards.

From the matters communicated with those charged with governance, we determine those matters that were of most significance in the audit of the financial statements for the financial year ended March 31, 2025 and are therefore the key Audit Matters. We describe these matters in our Auditor's Report unless law or regulation precludes public disclosure of these matters

**(6) Other Matter:**

Attention is drawn to the fact that the corresponding figures for the year ended March 31, 2025, are based on the previously issued audited financial statements of the Institute.

**Our opinion is not modified in respect of these matters**

**(7) Report on Other Regulatory Requirements:**

Further, we report that: -

a) We have obtained all the information and explanations which to the best of our knowledge and belief were necessary for the purpose of our audit subject to management representation letter;
b) In our opinion, proper books of account as required by law have been kept by the Institute so far as it appears from our examination of those books subject to management representation letter & key Audit Matters as reported in para (3) of this Audit Report; and

R S KAFALTIYA & ASSOCIATES
Chartered Accountants
FRN:024191C
HALDWANI

c) The Institute's Balance Sheet, the Statement of Income and Expenditure, and the Statement of Receipt & Payment dealt with by this Report are in agreement with the books of account, subject to management representation letter.

**For R S KAFALTIYA & ASSOCIATES**
**CHARTERED ACCOUNTANTS**

**CA. RAMA SHANKAR KAFALTIYA**
**FCA PROPRITEOR**
**FRN- 024191C**
**MRN- 411796**
**UDIN: 25411796BMKOYJ5681**

R S KAFALTIYA & ASSOCIATES
Chartered Accountants
FRN:024191C
HALDWANI

Place: Haldwani
Dated: September 24, 2025

## ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
## MANORA PEAK, NAINITAL

### BALANCE SHEET AS AT 31st MARCH 2025

(Amount in "INR")

| S. NO | PARTICULARS | Schedule | Current Year For the year ended 31st March 2025 | Previous Year For the year ended 31st March 2024 |
|---|---|---|---|---|
| | **CAPITAL FUND AND LIABILITIES** | | | |
| 1 | CAPITAL FUND | 1 | 1,24,88,01,305.97 | 1,29,46,28,084.56 |
| 2 | RESERVES AND SURPLUS | 2 | (70,62,874.05) | (70,62,874.05) |
| 3 | **NON - CURRENT LIABILITIES:** | | | |
| | EARMARKED/ ENDOWMENT FUNDS | 3 | 8,94,90,787.06 | 9,84,24,472.06 |
| | STAFF WELFARE FUND | 3A | 5,27,944.00 | 3,80,009.00 |
| | PROJECT FUND | 3B | 1,14,59,568.70 | 1,15,08,162.49 |
| 4 | SECURED LOANS AND BORROWINGS | 4 | - | - |
| 5 | UNSECURED LOANS AND BORROWINGS | 5 | - | - |
| 6 | DEFERRED CREDIT LIABILITIES | 6 | - | - |
| 7 | CURENT LIABILITIES AND PROVISIONS | 7 | 3,39,57,240.70 | 3,40,23,053.70 |
| | TOTAL LIABILITIES | | 1,37,71,73,972.38 | 1,43,19,00,907.76 |
| | **ASSETS** | | | |
| 9 | PROPERTY, PLANT & EQUIPMENT | 8 | 1,15,95,18,772.68 | 1,17,87,72,319.88 |
| 10 | INVESTMENTS - FROM ENDOWMENT FUNDS | 9 | 3,35,16,937.00 | 3,26,05,958.00 |
| 11 | INVESTMENTS - OTHERS | 10 | 27,05,948.00 | 25,75,930.00 |
| 12 | CURRENT ASSETS, LOANS, ADVANCES ETS. | 11 | 18,14,32,314.70 | 21,79,46,699.88 |
| 13 | MISCELLANEOUS EXPENDITURE (to the extent not written off or adjusted) | | - | - |
| | TOTAL ASSETS | | 1,37,71,73,972.38 | 1,43,19,00,907.76 |
| 14 | SIGNIFICANT ACCOUNTING POLICIES | 24 | | |
| 15 | CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS | 25 | | |

As per our separate Audit Report of even date attached.

For R.S.KAFALTIYA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. RAMA SHANKAR KAFALTIYA, FCA
PROPRIETOR
[FRN - 024191C]
[MRN - 411796]

PLACE : HALDWANI
DATED : September 24, 2025

R S KAFALTIYA & ASSOCIATES Chartered Accountants FRN:024191C HALDWANI

For and on behalf of ARIES, Nainital

(REGISTRAR) (DIRECTOR)

## ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
## MANORA PEAK, NAINITAL

### STATEMENT OF INCOME AND EXPENDITURE FOR THE YEAR ENDED 31st March 2025

(Amount in "INR")

| S. NO | PARTICULARS | SCH | Current Year<br>For the year ended 31st March 2025 | Previous Year<br>For the year ended 31st March 2024 |
|---|---|---|---|---|
| | **(A) INCOMES:** | | | |
| 1 | Income from Sales/Services | 12 | 7,00,887.00 | - |
| 2 | Grants/Subsidies - Establishment | 13 | 14,44,37,462.00 | 17,48,56,025.00 |
| | Grants/Subsidies - Other Admin Expenses | 13A | 14,88,00,000.00 | 14,44,00,000.00 |
| 3 | Project Grants | | - | - |
| 4 | Fees/Subscriptions | 14 | - | - |
| 5 | Income from Investments | 15 | 13,13,889.00 | 12,42,845.00 |
| 6 | Income from Royalty, Publication etc. | 16 | - | - |
| 7 | Interest Earned | 17 | 58,54,397.00 | 54,91,702.00 |
| 8 | Other Income | 18 | 99,05,882.88 | 91,84,415.00 |
| 9 | Increase/(decrese) in stock of Finished goods and works-in-progress | 19 | (1,02,120.42) | 4,32,081.35 |
| | TOTAL (A) | | 31,09,10,397.46 | 33,56,07,068.35 |
| | **(B) EXPENDITURES:** | | | |
| 10 | Establishment Expenses | 20 | 22,40,18,591.00 | 21,42,79,939.00 |
| 11 | Other Administrative Expenses etc. | 21 | 10,89,45,906.59 | 11,27,87,604.55 |
| 12 | Expenditure on Projects | 22 | - | - |
| 13 | Interest Expenditures | 23 | 33,03,466.00 | 37,38,096.00 |
| | TOTAL (B) | | 33,62,67,963.59 | 33,08,05,639.55 |
| | Balance being excess of Income / (Expenditure) (A - B) | | (2,53,57,566.13) | 48,01,428.80 |
| 14 | Depreciation (corresponding to Sch 9) | 8 | (14,23,69,212.46) | (14,81,83,528.75) |
| 15 | Transfer to Special Reserve (Specify each) | | - | - |
| 16 | Transfer to / from General Reserve | | | - |
| | BALANCE BEING SURPLUS/(DEFICIT) CARRIED TO CORPUS/ CAPITAL FUND | | (16,77,26,778.59) | (14,33,82,099.95) |
| | | | | |
| 18 | SIGNIFICANT ACCOUNTING POLICIES | 24 | | |
| 19 | CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS | 25 | | |

As per our separate Audit Report of even date attached.

For R.S.KAFALTIYA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. RAMA SHANKAR KAFALTIYA, FCA
PROPRIETOR
[FRN - 024191C]
[MRN - 411796]

R S KAFALTIYA & ASSOCIATES Chartered Accountants FRN:024191C HALDWANI

PLACE : HALDWANI
DATED : September 24, 2025

For and on behalf of ARIES, Nainital

(REGISTRAR) (DIRECTOR)

ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
MANORA PEAK, NAINITAL

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st March 2025

| | SCHEDULE 1 - CAPITAL FUND | | (Amount in "INR") |
|---|---|---|---|
| S.NO | PARTICUALRS | Current Year<br>For the year ended 31st March 2025<br>(Credit) | Previous Year<br>For the year ended 31st March 2024<br>(Credit) |
| 1 | Balance as at the beginning of the year | 1,29,46,28,084.56 | 1,30,05,74,347.51 |
| 2 | Add : Contributions towards Capital Fund | 12,19,00,000.00 | 17,17,00,000.00 |
| 3 | Add / (Deduct) : Balance of net Income / -(Expenditure) transferred from the Income and Expenditure Account | (16,77,26,778.59) | (14,33,82,099.95) |
| 4 | Add / (Deduct) : Unspent Grant | - | (3,42,64,163.00) |
| | BALANCE AS AT THE YEAR - END | 1,24,88,01,305.97 | 1,29,46,28,084.56 |

| | SCHEDULE 2 - RESERVES AND SURPLUS | | |
|---|---|---|---|
| S.NO | PARTICUALRS | Current Year<br>For the year ended 31st March 2025<br>(Credit) | Current Year<br>For the year ended 31st March 2024<br>(Credit) |
| 1 | **Capital Reserve :** | | |
| | As per last Account | - | - |
| | Addition / (Dedutions) during the year | - | - |
| 2 | **Revaluation Reserve :** | | |
| | As per last Account | - | - |
| | Addition / (Dedutions) during the year | - | - |
| 3 | **Special Reserves :** | | |
| | As per last Account | - | - |
| | Addition / (Dedutions) during the year | - | - |
| 4 | **General Reserve :** | | |
| | As per last Account (31.03.2024) | (70,62,874.05) | (56,76,772.05) |
| | Additions during the year | - | (13,86,102.00) |
| | (Dedutions) during the year | - | - |
| | TOTAL | (70,62,874.05) | (70,62,874.05) |

Annexed to the Balance Sheet of even date attached.

For R.S.KAFALTIYA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. RAMA SHANKAR KAFALTIYA, FCA
PROPRIETOR
[FRN - 024191C]
[MRN - 411796]

PLACE : HALDWANI
DATED : September 24, 2025

R S KAFALTIYA & ASSOCIATES Chartered Accountants FRN:024191C *HALDWANI*

For and on behalf of ARIES, Nainital

(REGISTRAR)

(DIRECTOR)

ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
MANORA PEAK, NAINITAL

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st March 2025

| S.NO | SCHEDULE 3 - EARMARKED/ENDOWMENT FUNDS | | | | | | (Amount in "INR") |
|---|---|---|---|---|---|---|---|
| | PARTICUALRS | Fund Wise Breakup | | | | Current Year Total | Previous Year Total |
| | | | | | | For the year ended 31st March 2025 | For the year ended 31st March 2024 |
| | | GPF Fund | GPF Reserve | Pension Fund | Pension Reserve | (Credit) | (Credit) |
| A | Opening Balance of Funds | 5,68,81,673.00 | 48,79,418.56 | 1,46,84,108.56 | 2,19,79,271.94 | 9,84,24,472.06 | 8,77,57,428.06 |
| | Total (A) | 5,68,81,673.00 | 48,79,418.56 | 1,46,84,108.56 | 2,19,79,271.94 | 9,84,24,472.06 | 8,77,57,428.06 |
| B | Additions : | | | | | | |
| | a) Employee's Contributions | 45,85,220.00 | | - | | 45,85,220.00 | 51,06,780.00 |
| | b) Interest Accrued | 33,03,466.00 | | | | 33,03,466.00 | 37,38,096.00 |
| | c) Recoveries of Advances | | | | | - | - |
| | d) Transferred from Reserve | | | | | - | - |
| | e) Interest Contribution | | | | | - | - |
| | f) Endowment Surplus | | | | | - | - |
| | g) Pension Payable | | | | | - | - |
| | h) Other Credits | | | 5,08,704.00 | | 5,08,704.00 | 1,07,67,285.00 |
| | TOTAL (B) | 78,88,686.00 | - | 5,08,704.00 | - | 83,97,390.00 | 1,96,12,161.00 |
| C | Utilisation/Payments: | | | | | | |
| | a) Capital Payments: | | | | | | - |
| | Transferred to GPF Fund | 1,25,46,545.00 | | | | 1,25,46,545.00 | 52,97,306.00 |
| | b) Revenue Payments: | | | | | | - |
| | -Permanent Withdrawls | | | 47,84,530.00 | | 47,84,530.00 | 36,47,811.00 |
| | -Recoverable Advances | | | | | - | |
| | -Retirement Payment | | | | | - | |
| | -Advances of Previous yrs | | | | | - | - |
| | -Pension (Last year Prov) | | | | | - | - |
| | TOTAL (C) | 1,25,46,545.00 | - | 47,84,530.00 | - | 1,73,31,075.00 | 89,45,117.00 |
| | NET BALANCE [A + B - C] | 5,22,23,814.00 | 48,79,418.56 | 1,04,08,282.56 | 2,19,79,271.94 | 8,94,90,787.06 | 9,84,24,472.06 |

* Pension fund reinstated for payment of Leave encashment of Rs. 53,45,708/- Gratuity of Rs. 82,07,733/- during F.Y. 2024-25 which was made out of pension funds.

Annexed to the Balance Sheet of even date attached.

For R.S.KAFALTIYA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. RAMA SHANKAR KAFALTIYA, FCA
PROPRIETOR
[FRN - 024191C]
[MRN - 411796]

PLACE : HALDWANI
DATED : September 24, 2025

R S KAFALTIYA & ASSOCIATES Chartered Accountants FRN:024191C *HALDWANI*

For and on behalf of ARIES, Nainital

(REGISTRAR) (DIRECTOR)

# ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
## MANORA PEAK, NAINITAL

### SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st March 2025

| | SCHEDULE 3A - STAFF WELFARE FUND | | (Amount in "INR") |
|---|---|---|---|
| S.NO | PARTICUALRS | Current Year<br>For the year ended 31st March 2025<br>(Credit) | Previous Year<br>For the year ended 31st March 2024<br>(Credit) |
| 1 | Balance as at the beginning of the year | 3,80,009.00 | 2,98,530.00 |
| 2 | ADD: | | |
| | Staff Contribution Received | 2,93,797.00 | 1,34,245.00 |
| | Bank Interest | 12,548.00 | 9,093.00 |
| 3 | TOTAL STAFF WELFARE FUND VALUE (1 + 2) | 6,86,354.00 | 4,41,868.00 |
| 4 | LESS: | | |
| | Staff Welfare Expenses | 1,58,410.00 | 61,859.00 |
| | TOTAL STAFF WELFARE EXPENSES (4) | 1,58,410.00 | 61,859.00 |
| | BALANCE AS AT THE YEAR - END [3 - 4] | 5,27,944.00 | 3,80,009.00 |

Annexed to the Balance Sheet of even date attached.

For R.S.KAFALTIYA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. RAMA SHANKAR KAFALTIYA, FCA
PROPRIETOR
[FRN - 024191C]
[MRN - 411796]

R S KAFALTIYA & ASSOCIATES Chartered Accountants FRN:024191C HALDWANI

PLACE : HALDWANI
DATED : September 24, 2025

For and on behalf of ARIES, Nainital

(REGISTRAR)

(DIRECTOR)

ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
MANORA PEAK, NAINITAL

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st March 2025

| | SCHEDULE 3B- PROJECT FUND | | (Amount in "INR") |
|---|---|---|---|
| S.NO | PARTICUALRS | Current Year For the year ended 31st March 2025 (Credit) | Previous Year For the year ended 31st March 2024 (Credit) |
| 1 | ST RADAR PROJECT | 23,35,007.00 | 22,73,139.00 |
| 2 | Baker Nunn Schimidit Telescope | 15,22,718.00 | - |
| 3 | ISRO-GBP-ABLN & C PROJECT | 12,79,076.00 | 21,32,580.00 |
| 4 | SRG/2023/002623 (SERB) | 8,90,445.00 | 9,60,107.00 |
| 5 | SERB(SRS)/22-23/113 | 8,04,236.00 | 6,15,894.00 |
| 6 | DST/ INSPIRE FELLOWHIP PROJECT | (4,62,000.00) | - |
| 7 | SRG/2022/001687 | 4,33,741.00 | 4,43,755.00 |
| 8 | Project Fund A/c (SRE-SERB) | 2,64,519.21 | 2,64,284.00 |
| 9 | ADITYA-L 1 PROJECT | 2,43,541.00 | 2,43,379.50 |
| 10 | VAJRA Faculty Scheme | 2,07,335.00 | - |
| 11 | ISRO - ATCTM PROJECT | 2,00,311.54 | 8,50,401.54 |
| 12 | CRG/2021/005876 SERB | 1,83,419.00 | - |
| 13 | Project Account (UCOST) | 1,60,081.45 | 1,60,078.45 |
| 14 | Project Account NPDF/2022/001040/SERB | 1,48,537.00 | 2,24,474.00 |
| 15 | EMR-2016-1723 PROJECT | 29,877.00 | 29,877.00 |
| 16 | Project Fund A/c (INDO-THAI P-15/2019 PROJECT) | 121.50 | 94,363.50 |
| 17 | (ISRO- ARFI PROJECT) | 36.00 | - |
| 18 | ASTRO-SAT-PROJECT | - | 7,714.50 |
| 19 | Miscellaneous Project Grants | 32,18,567.00 | 32,08,115.00 |
| | TOTAL | 1,14,59,568.70 | 1,15,08,162.49 |

Annexed to the Balance Sheet of even date attached.

For R.S.KAFALTIYA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. RAMA SHANKAR KAFALTIYA, FCA
PROPRIETOR
[FRN - 024191C]
[MRN - 411796]

R S KAFALTIYA & ASSOCIATES Chartered Accountants FRN:024191C HALDWANI

PLACE : HALDWANI
DATED : September 24, 2025

For and on behalf of ARIES, Nainital

(REGISTRAR) (DIRECTOR)

## ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
## MANORA PEAK, NAINITAL

### SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st March 2025

| | SCHEDULE 4 - SECURED LOANS AND BORROWINGS | | (Amount in "INR") |
|---|---|---|---|
| S.NO | PARTICUALRS | Current Year | Previous Year |
| | | For the year ended 31st March 2025 | For the year ended 31st March 2024 |
| | | (Credit) | (Credit) |
| 1 | Central Government | - | - |
| 2 | State Government | - | - |
| 3 | Financial Institutions | | |
| | a) Term Loans | - | - |
| | b) Interest accrued and due | - | - |
| 4 | Banks: | | |
| | a) Term Loans | - | - |
| | Interest accrued and due | - | - |
| | b) Other Loans | - | - |
| | Interest accrued and due | - | - |
| 5 | Other Institutions and Agencies | - | - |
| 6 | Debentures and Bonds | - | - |
| 7 | Others | - | - |
| | TOTAL | - | - |

Annexed to the Balance Sheet of even date attached.

For R.S.KAFALTIYA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. RAMA SHANKAR KAFALTIYA, FCA
PROPRIETOR
[FRN - 024191C]
[MRN - 411796]

PLACE : HALDWANI
DATED : September 24, 2025

(R S KAFALTIYA & ASSOCIATES, Chartered Accountants, FRN:024191C, HALDWANI)

For and on behalf of ARIES, Nainital

(REGISTRAR) (DIRECTOR)

ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
MANORA PEAK, NAINITAL

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st March 2025

| | SCHEDULE 5 - UNSECURED LOANS AND BORROWINGS | (Amount in "INR") | |
|---|---|---|---|
| S.NO | PARTICUALRS | Current Year<br>For the year ended 31st March 2025<br>(Credit) | Previous Year<br>For the year ended 31st March 2024<br>(Credit) |
| 1 | Central Government | - | - |
| 2 | State Government (Specify) | - | - |
| 3 | Financial Institutions | - | - |
| 4 | Banks: | | |
| | a) Term Loans | - | - |
| | b) Other Loans (specify) | - | - |
| 5 | Other Institutions and Agencies | - | - |
| 6 | Debentures and Bonds | - | - |
| 7 | Fixed Deposits | - | - |
| 8 | Others (Specify) | - | - |
| | TOTAL | - | - |

| | SCHEDULE 6 - DEFERRED CREDIT LIABILITIES | (Amount in "INR") | |
|---|---|---|---|
| S.NO | PARTICUALRS | Current Year<br>For the year ended 31st March 2025<br>(Credit) | Previous Year<br>For the year ended 31st March 2024<br>(Credit) |
| 1 | Acceptances secured by hypothecation of Capital Equipments and other assets | - | - |
| 2 | Others | - | - |
| | TOTAL | - | - |

Annexed to the Balance Sheet of even date attached.

For R.S.KAFALTIYA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. RAMA SHANKAR KAFALTIYA, FCA
PROPRIETOR
[FRN - 024191C]
[MRN - 411796]

PLACE : HALDWANI
DATED : September 24, 2025

R S KAFALTIYA & ASSOCIATES Chartered Accountants FRN:024191C HALDWANI

For and on behalf of ARIES, Nainital

(REGISTRAR)

(DIRECTOR)

ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
MANORA PEAK, NAINITAL

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st March 2025

| S.NO | SCHEDULE 7 - CURRENT LIABILITIES AND PROVISIONS PARTICUALRS | Current Year For the year ended 31st March 2025 | | Previous Year For the year ended 31st March 2024 (Amount in "INR") | |
|---|---|---|---|---|---|
| | | (Credit) | (Credit) | (Credit) | (Credit) |
| | **A. CURRENT LIABILITIES:** | | | | |
| 1 | Acceptances | - | - | - | - |
| 2 | Sundry Creditors (YAM) | 21,558.00 | 21,558.00 | 21,558.00 | 21,558.00 |
| 3 | Advances Received - Scientific Meeting | - | - | - | - |
| 4 | **Interest accrued but not due on:** | | | | |
| | a) Secured Loans /borrowings | - | | - | |
| | b) Unsecured Loans/borrowings | - | - | - | - |
| 5 | Interest on SBI (Director's) Bank A/C - 253 | | | | |
| | - Financial Year 2024-25 | 46,66,704.00 | | - | |
| | - Financial Year 2023-24 | - | | 40,83,681.00 | |
| | - Financial Year 2022-23 | - | 46,66,704.00 | 40,54,223.00 | 81,37,904.00 |
| 6 | **Statutory Liabilities:** | | | | |
| | a) GST under Reverse Charge and Scrap | - | | 98,542.00 | |
| | b) GST TDS Payable | 3,61,911.00 | | 6,11,190.00 | |
| | c) TDS Payable | 2,16,755.00 | | 3,72,599.00 | |
| | d) Labour Cess (March 2023) | 11,329.00 | | 64,160.00 | |
| | e) NPS (Employee's Contribution) | (9,96,047.00) | | (2,00,402.00) | |
| | f) NPS (Employer's Contribution) | (26,541.00) | | (26,541.00) | |
| | g) NPS of R.Kumar (Employee Contribution) | 8,41,951.00 | | 8,41,951.00 | |
| | h) NPS of R.Kumar (Employer Contribution) | 10,56,777.00 | 14,66,135.00 | 10,56,777.00 | 28,18,276.00 |
| 7 | **Other Curent Liabilities:** | | | | |
| | a) Earnest Money Deposits | 2,32,934.00 | | 40,000.00 | |
| | b) Performance Security Deposits | 9,96,102.00 | | 7,93,989.00 | |
| | c) EMD Abdulla | 50,000.00 | | - | |
| | c) Other Securities - Mahi Traders | 42,395.00 | | 53,787.00 | |
| | e) Other Securities - Kandpal Buildcare | 1,03,009.00 | | 28,577.00 | |
| | f)EMD ION Science India Pvt. Ltd. | 45,000.00 | | - | |
| | g) Outstanding Expenses* | 2,34,83,778.00 | | 1,92,18,597.00 | |
| | h) Group Insurance | (2,070.00) | | (1,020.00) | |
| | i) G. N. Pathak - Pensioner | 39,774.00 | | 39,774.00 | |
| | j) L S kanwal - Pensioner | 12,071.00 | | 12,071.00 | |
| | k) Shyam Giri - Pensioner | 7,243.00 | | 7,243.00 | |
| | l) Om Speciality Gases | 12,602.00 | | - | |
| | m) Staff Welfare Payable | 150.00 | | 150.00 | |
| | n) Contingency Expenses (CSIR) | 88,438.00 | | 88,438.00 | |
| | o) Ashoka Construction | 1,74,000.00 | | 1,74,000.00 | |
| | p) CGM Computers | - | | 20,000.00 | |
| | q) PR Sales | - | | 20,600.00 | |
| | r) Contingency Project Payable | 2,037.00 | | 59,993.00 | |
| | s) Election TA Bills | 1,855.00 | | 1,855.00 | |
| | t) Environment-SA | | | 48,000.00 | |
| | u) Rahul Sirohi | 50,500.00 | | 50,500.00 | |
| | v) Extraneous Credits* | 24,63,025.70 | 2,78,02,843.70 | 23,88,761.70 | 2,30,45,315.70 |
| | **TOTAL (A)** | | 3,39,57,240.70 | | 3,40,23,053.70 |
| | **B. PROVISIONS :** | | | | |
| 1 | Taxation | | - | | - |
| 2 | Gratuity | | - | | - |
| 3 | Accumulated Leave Encashment | | - | | - |
| 4 | Others (Specify) | | - | | - |
| | **TOTAL (B)** | | - | | - |
| | **TOTAL (A+B)** | | 3,39,57,240.70 | | 3,40,23,053.70 |

* Separate List Attached.

Annexed to the Balance Sheet of even date attached.

For R.S.KAFALTIYA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. RAMA SHANKAR KAFALTIYA, FCA
PROPRIETOR
[FRN - 024191C]
[MRN - 411796]

PLACE : HALDWANI
DATED : September 24, 2025

R S KAFALTIYA & ASSOCIATES Chartered Accountants FRN:024191C

For and on behalf of ARIES, Nainital

(REGISTRAR)

(DIRECTOR)

ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
MANORA PEAK, NAINITAL
SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st March 2025

**SCHEDULE 8 - PROPERTY, PLANT & EQUIPMENT:**

(Amount in "INR")

| S.NO. | DESCRIPTION | Rate | GROSS BLOCK | | | | | DEPRECIATION | | | | NET BLOCK | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cost/valuation As at beginning of the year (01.04.2024) | Additions During the Year (> 180 days) | Additions During the Year (< 180 days) | Sales/Deductions / W-off during the year | Cost/valuation at the year end (31.03.2025) | As at the beginning of the year (01.04.2024) | On [Op. WDV + Additions - Sale/Ded/W-off (> 180 days) - Deductions] | On Additions During the Year (< 180 days) | Total Depreciation up to the year end (31.03.2025) | As at the Current Year end (31.03.2025) | As at the Previous Year end (31.03.2024) |
| | | | (1) | (2) | (3) | (4) | 5 (1+2+3-4) | (6) | (7) | (8) | 9 (7+8) | 10 (5-9) | (11) |
| 1 | **PROPERTY, PLANT & EQUIPMENT:** | | | | | | | | | | | | |
| A | LAND: | 0% | | | | | | | | | | | |
| | LAND | | 10,58,50,429.00 | - | - | - | 10,58,50,429.00 | - | | | - | 10,58,50,429.00 | 10,58,50,429.00 |
| | **TOTAL (A)** | | **10,58,50,429.00** | - | - | - | **10,58,50,429.00** | - | - | - | - | **10,58,50,429.00** | **10,58,50,429.00** |
| B | **BUILDINGS & INFRASTRUCTURES** | 10% | | | | | | | | | | | |
| | Building 3.60 Telescope | | 3,46,01,869.00 | - | - | - | 3,46,01,869.00 | 2,12,70,992.43 | 13,33,087.66 | - | 2,26,04,080.09 | 1,19,97,788.9101 | 1,33,30,876.57 |
| | Building Non-Res (Devsthal) | | 2,85,27,064.00 | - | - | - | 2,85,27,064.00 | 1,47,98,775.53 | 13,72,828.85 | - | 1,61,71,604.37 | 1,23,55,459.6272 | 1,37,28,288.47 |
| | Building Non-Res (Manora Peak) | | 11,74,33,187.00 | 1,89,27,478.00 | | - | 13,63,60,665.00 | 8,70,89,994.04 | 49,27,067.10 | - | 9,20,17,061.14 | 4,43,43,603.8604 | 3,03,43,192.96 |
| | Building 4MT Telescope | | 2,54,69,905.00 | - | | - | 2,54,69,905.00 | 48,39,281.95 | 20,63,062.31 | - | 69,02,344.26 | 1,85,67,560.7450 | 2,06,30,623.05 |
| | Infrastructure Dev. (Dev Sthal) | | 5,14,94,023.90 | | | | 5,14,94,023.90 | 3,20,59,535.89 | 19,43,448.80 | - | 3,40,02,984.69 | 1,74,91,039.2096 | 1,94,34,488.01 |
| | Infrastructure Dev. (Manora Peak) | | 1,72,24,746.70 | 37,87,545.00 | 3,08,75,340.26 | | 5,18,87,631.96 | 1,30,81,631.20 | 7,93,066.05 | 15,48,767.01 | 1,54,18,464.26 | 3,64,69,167.7010 | 41,43,115.50 |
| | Roads at Devsthal | | 4,64,54,564.00 | | | | 4,64,54,564.00 | 1,89,44,681.59 | 27,50,988.24 | - | 2,16,95,669.83 | 2,47,58,894.1739 | 2,75,09,882.41 |
| | **TOTAL (B)** | | **32,12,05,359.60** | **2,27,15,023.00** | **3,08,75,340.26** | - | **37,47,95,722.86** | **19,20,84,892.62** | **1,51,83,549.00** | **15,43,767.01** | **20,88,12,208.64** | **16,59,83,514.22** | **12,91,20,466.98** |
| C | Buildings - Residential | 5% | | | | | | | | | | | |
| | Guest House (Devsthal) | | 12,24,022.00 | 16,598.00 | 13,499.00 | - | 12,54,119.00 | 6,91,481.81 | 27,456.91 | 337.48 | 7,19,276.19 | 5,34,842.81 | 5,32,540.19 |
| | Building Residential (Manora Peak) | | 4,05,56,288.60 | | | - | 4,05,56,288.60 | 1,40,16,853.22 | 13,26,971.77 | - | 1,53,43,824.99 | 2,52,12,463.61 | 2,65,39,435.38 |
| | **TOTAL (C)** | | **4,17,80,310.60** | **16,598.00** | **13,499.00** | - | **4,18,10,407.60** | **1,47,08,335.03** | **13,54,428.68** | **337.48** | **1,60,63,101.18** | **2,57,47,306.42** | **2,70,71,975.57** |
| D | VEHICLES | 15% | | | | | | | | | | | |
| | Vehicle | | 74,67,053.10 | | 7,18,000.00 | | 81,85,053.10 | 46,61,555.34 | 4,20,824.66 | 53,850.00 | 51,36,230.00 | 30,48,823.10 | 28,05,497.76 |
| | **TOTAL (D)** | | **74,67,053.10** | - | **7,18,000.00** | - | **81,85,053.10** | **46,61,555.34** | **4,20,824.66** | **53,850.00** | **51,36,230.00** | **30,48,823.10** | **28,05,497.76** |
| E | FURNITURE AND FIXTURES | 10% | | | | | | | | | | | |
| | Furniture & Fixture | | 4,05,30,554.70 | 22,61,678.00 | 19,31,693.00 | - | 4,47,23,925.70 | 1,31,11,686.07 | 29,68,054.66 | 96,584.65 | 1,61,76,325.38 | 2,85,47,600.32 | 2,74,18,868.63 |
| | **TOTAL (E)** | | **4,05,30,554.70** | **22,61,678.00** | **19,31,693.00** | - | **4,47,23,925.70** | **1,31,11,686.07** | **29,68,054.66** | **96,584.65** | **1,61,76,325.38** | **2,85,47,600.32** | **2,74,18,868.63** |
| F | OFFICE EQUIPMENTS | 10% | | | | | | | | | | | |
| | Office Equipment | | 85,12,942.25 | 18,644.00 | 3,75,109.00 | | 89,06,695.25 | 23,29,402.82 | 6,20,218.34 | 18,755.45 | 29,68,376.61 | 59,38,318.64 | 61,83,539.43 |
| | **TOTAL (F)** | | **85,12,942.25** | **18,644.00** | **3,75,109.00** | - | **89,06,695.25** | **23,29,402.82** | 6,20,218.34 | **18,755.45** | **29,68,376.61** | 59,38,318.64 | **61,83,539.43** |
| G | **COMPUTER/PERIPHERALS** | 40% | | | | | | | | | | | |
| | Computer & Peripherals | | 8,80,03,002.40 | 55,79,172.00 | 20,46,523.00 | | 9,56,28,697.40 | 7,19,02,151.87 | 86,72,009.01 | 4,09,304.60 | 8,09,83,465.46 | 1,46,45,231.92 | 1,61,00,850.53 |
| | Computer Software | | 1,40,05,566.24 | 13,61,649.00 | 3,11,063.00 | | 1,56,78,278.24 | 93,92,084.69 | 23,90,062.22 | 62,212.60 | 1,18,44,349.51 | 38,33,928.73 | 46,13,481.55 |
| | TOTAL (G) | | **10,20,08,568.64** | **69,40,821.00** | **23,57,586.00** | - | **11,13,06,975.64** | 8,12,94,236.56 | **1,10,62,061.23** | 4,71,517.20 | **9,28,27,814.99** | **1,84,79,160.65** | **2,07,14,332.08** |
| H | ELECTRIC INSTALLATIONS | 15% | | | | | | | | | | | |
| | Electrical (Non-Consumable) | | 2,51,87,517.00 | 2,91,253.00 | 52,050.00 | | 2,55,30,820.00 | 80,45,461.40 | 26,14,986.29 | 3,903.75 | 1,06,64,361.44 | 1,48,66,458.56 | 1,71,42,055.60 |
| | Electric Instalation (Devasthal) | | 82,01,277.00 | 49,43,633.00 | 17,788.00 | | 1,31,62,698.00 | 48,95,511.10 | 12,37,409.84 | 1,334.10 | 61,34,255.03 | 70,28,442.97 | 33,05,765.90 |
| | Electric Instalation (Manora Peak) | | 2,95,69,910.72 | 91,12,169.00 | 44,86,107.00 | | 4,31,68,186.72 | 1,29,17,706.48 | 38,64,655.99 | 3,36,458.03 | 1,71,18,820.49 | 2,60,49,366.23 | 1,66,52,204.24 |
| | Electronic Section | | 92,40,897.55 | | | | 92,40,897.55 | 85,89,327.14 | 97,735.56 | - | 86,87,062.70 | 5,53,834.85 | 6,51,570.41 |
| | Electronic Substation-DOT 3.6 Mt | | 2,11,88,424.00 | | | | 2,11,88,424.00 | 73,06,027.49 | 20,82,359.48 | - | 93,88,386.97 | 1,18,00,037.03 | 1,38,82,396.51 |
| | Solar Section | | 6,380.79 | | | | 6,380.79 | 6,380.79 | - | - | 6,380.79 | - | - |
| | **TOTAL (H)** | | **9,33,94,407.06** | **1,43,47,055.00** | **45,55,945.00** | - | **11,22,97,407.06** | **4,17,60,414.40** | **98,97,157.15** | **3,41,695.88** | **5,19,99,267.43** | **6,02,98,139.63** | **5,16,33,992.66** |
| I | LIBRARY BOOKS | 40% | | | | | | | | | | | |
| | Library Books | | 6,01,78,105.50 | 1,02,929.00 | 1,40,025.00 | | 6,04,21,059.50 | 5,93,49,041.29 | 3,72,797.28 | 28,005.00 | 5,97,49,843.57 | 6,71,215.93 | 8,29,064.21 |
| | **TOTAL (I)** | | 6,01,78,105.50 | 1,02,929.00 | 1,40,025.00 | - | 6,04,21,059.50 | 5,93,49,041.29 | 3,72,797.28 | 28,005.00 | 5,97,49,843.87 | 6,71,215.93 | 8,29,064.21 |

Continued to page - 2-

R S KAFALTIYA & ASSOCIATES
Chartered Accountants
FRN 024191C
HALDWANI

Page - 2 -

| S.NO. | DESCRIPTION | Rate | GROSS BLOCK | | | | | DEPRECIATION | | | | NET BLOCK | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cost/valuation As at beginning of the year (01.04.2024) | Additions During the Year (> 180 days) | Additions During the Year (< 180 days) | Sales/Deductions / W-off during the year | Cost/valuation at the year end (31.03.2025) | As at the beginning of the year (01.04.2024) | On [Op. WDV + Additions - Sale/Ded/W-off (> 180 days) - Deductions] | On Additions During the Year (< 180 days) | Total Depreciation up to the year end (31.03.2025) | As at the Current Year end (31.03.2025) | As at the Previous Year end (31.03.2024) |
| | | | (1) | (2) | (3) | (4) | 5 (1+2+3-4) | (6) | (7) | (8) | 9 (7+8) | 10 (5-9) | (11) |
| J | **PLANT MACHINERY & EQUIPMENT** | 15% | | | | | | | | | | | |
| | Telescope - DOT 3.6 Mt | | 1,29,11,63,101.00 | 2,49,865.00 | | | 1,29,14,12,966.00 | 91,95,56,495.86 | 5,57,78,470.52 | - | 97,53,34,966.38 | 31,60,77,999.62 | 37,16,06,605.14 |
| | Telescope - 1.3 Mt | | 9,22,77,149.00 | | | | 9,22,77,149.00 | 7,76,50,930.02 | 21,93,932.85 | - | 7,98,44,862.87 | 1,24,32,286.13 | 1,46,26,218.98 |
| | Telescope | | 1,60,36,766.55 | | | | 1,60,36,766.55 | 1,00,83,533.89 | 8,92,984.90 | - | 1,09,76,518.79 | 50,60,247.76 | 59,53,232.66 |
| | Backend Instrument -Modernization | | 16,46,39,367.00 | | | | 16,46,39,367.00 | 10,84,03,282.62 | 84,35,412.66 | - | 11,68,38,695.28 | 4,78,00,671.72 | 5,62,36,084.38 |
| | Backend Instrument - ADFOSC | | 52,41,235.00 | | | | 52,41,235.00 | 35,50,993.38 | 2,53,536.24 | - | 38,04,529.62 | 14,36,705.38 | 16,90,241.62 |
| | Instruments | | 10,94,95,384.67 | | | | 10,94,95,384.67 | 9,22,72,424.18 | 25,83,444.07 | - | 9,48,55,868.25 | 1,46,39,516.41 | 1,72,22,960.49 |
| | Aluminization Plant (Devsthal) | | 3,95,23,736.00 | | | | 3,95,23,736.00 | 2,87,53,892.35 | 16,15,476.55 | - | 3,03,69,368.89 | 91,54,367.11 | 1,07,69,843.65 |
| | LIDAR Project | | 93,62,289.00 | | | | 93,62,289.00 | 80,67,314.67 | 1,94,246.15 | - | 82,61,560.82 | 11,00,728.18 | 12,94,974.33 |
| | Optics | | 1,48,96,574.80 | 19,81,211.00 | 2,65,469.00 | | 1,71,43,254.80 | 41,32,109.89 | 19,11,851.39 | 19,910.18 | 60,63,871.45 | 1,10,79,383.35 | 1,07,64,464.91 |
| | High Resolution Spectograph (HRS) | | 8,39,38,022.00 | | 43,68,593.00 | | 8,83,06,615.00 | 1,46,81,305.73 | 1,08,58,507.44 | 3,27,644.48 | 2,55,67,457.64 | 6,27,39,157.36 | 6,90,56,716.27 |
| | CSNOF-09 - 4.2 ILMT Project | | 7,20,091.00 | 20,53,266.00 | 16,36,906.00 | | 44,10,263.00 | 1,64,029.40 | 3,91,399.14 | 1,22,767.95 | 6,78,196.49 | 37,32,066.51 | 5,56,061.60 |
| | CSNOF-05 - WG-02 (ASTRAD) | | 60,36,350.00 | | 2,44,871.00 | | 62,81,221.00 | 6,61,868.33 | 8,06,172.25 | 18,365.33 | 14,86,405.90 | 47,94,815.10 | 53,74,481.68 |
| | Telescope ( Schmidt) | | 1,07,38,623.00 | | | | 1,07,38,623.00 | 97,85,157.76 | 1,43,019.79 | - | 99,28,177.54 | 8,10,445.46 | 9,53,465.24 |
| | Planetarium (Public Outreach) | | 87,31,511.00 | 90,117.00 | | | 88,21,628.00 | 37,01,028.80 | 7,68,089.88 | - | 44,69,118.68 | 43,52,509.32 | 50,30,482.20 |
| | Projector (Public Outreach) | | 1,05,000.00 | | | | 1,05,000.00 | 91,184.56 | 2,072.32 | - | 93,256.87 | 11,743.13 | 13,815.44 |
| | Spectrometer | | 10,62,951.00 | | | | 10,62,951.00 | 7,47,750.35 | 47,280.10 | - | 7,95,030.44 | 2,67,920.56 | 3,15,200.65 |
| | Telescope (Public Out Reach) | | 11,02,295.00 | 4,99,671.00 | | | 16,01,966.00 | 5,70,994.49 | 1,54,645.73 | - | 7,25,640.22 | 8,76,325.78 | 5,31,300.51 |
| | Telescope Solar | | 20,16,145.00 | | | | 20,16,145.00 | 15,10,633.23 | 75,826.77 | - | 15,86,459.99 | 4,29,685.01 | 5,05,511.77 |
| | ST RADAR | | 18,64,642.00 | | | | 18,64,642.00 | 10,37,290.28 | 1,24,102.76 | - | 11,61,393.04 | 7,03,248.96 | 8,27,351.72 |
| | ASTRAD - CSNOF-05 | | 2,26,17,807.00 | 5,90,000.00 | 57,06,700.00 | | 2,89,14,507.00 | 77,99,093.49 | 23,11,307.03 | 4,28,002.50 | 1,05,38,403.07 | 1,83,76,103.98 | 1,48,18,713.51 |
| | Telescope Enclosure - 3.6 Mt | | 2,09,96,199.00 | 3,84,474.00 | 12,38,411.00 | | 2,26,19,084.00 | 86,40,874.15 | 19,10,969.83 | 92,880.83 | 1,06,44,724.80 | 1,19,74,359.20 | 1,23,55,324.85 |
| | Coating Plant-40 Inch | | 23,56,985.00 | | | | 23,56,985.00 | 1,76,773.88 | 3,27,031.67 | - | 5,03,805.54 | 18,53,179.46 | 21,80,211.13 |
| | Plant & Machinery-Others | | | 34,72,201.00 | 53,01,357.00 | | 87,73,558.00 | - | 5,20,830.15 | 3,97,601.78 | 9,18,431.93 | 78,55,126.08 | - |
| | **TOTAL (J)** | | **1,90,49,22,224.02** | **93,20,805.00** | **1,87,62,307.00** | - | **1,93,30,05,336.02** | **1,30,22,38,961.29** | **9,18,00,610.16** | **14,07,173.03** | **1,39,54,46,744.48** | **53,75,58,591.54** | **60,26,83,262.73** |
| K | **OTHER FIXED ASSETS** | 15% | | | | | | | | | | | |
| | Aluminising / Anodising | | 89,358.67 | | | | 89,358.67 | 89,358.67 | - | - | 89,358.67 | - | - |
| | Atmospheric Science Division (ASD) | | 1,19,25,119.00 | 6,47,550.00 | 44,840.00 | | 1,26,17,509.00 | 25,18,855.88 | 15,08,071.97 | 3,363.00 | 40,30,290.85 | 85,87,218.15 | 94,06,263.12 |
| | Canteen Assets | | 9,63,829.00 | 2,37,859.00 | | | 12,01,688.00 | 2,90,365.94 | 1,36,698.31 | - | 4,27,064.25 | 7,74,623.75 | 6,73,463.06 |
| | CCTV Camera | | 77,500.00 | | | | 77,500.00 | 54,518.56 | 3,447.22 | - | 57,965.78 | 19,534.22 | 22,981.44 |
| | Gym Assets | | 4,67,862.00 | 88,995.00 | | | 5,56,857.00 | 1,70,397.55 | 57,968.92 | - | 2,28,366.47 | 3,28,490.53 | 2,97,464.45 |
| | Library Instrument | | 9,500.00 | | | | 9,500.00 | 6,911.27 | 388.31 | - | 7,299.58 | 2,200.42 | 2,588.73 |
| | Workshop Assets | | 1,68,07,373.45 | 7,39,648.00 | 6,12,273.00 | | 1,81,59,294.45 | 41,75,505.91 | 20,05,727.33 | 45,920.48 | 62,27,153.71 | 1,19,32,140.74 | 1,26,31,867.54 |
| | Hostel Assets | | 5,36,873.00 | | 23,100.00 | | 5,59,973.00 | 1,89,649.14 | 52,083.58 | 1,732.50 | 2,43,465.22 | 3,16,507.78 | 3,47,223.86 |
| | Guest House Assets | | 13,48,609.00 | 17,298.00 | | | 13,65,907.00 | 2,38,236.74 | 1,69,150.54 | - | 4,07,387.26 | 9,58,519.72 | 11,10,372.26 |
| | EPABX Telephone Assets | | 8,75,000.00 | 29,19,990.00 | | | 37,94,990.00 | 86,576.25 | 5,56,262.06 | - | 6,42,838.31 | 31,52,151.69 | 7,88,423.75 |
| | Sports Items | | - | - | 41,600.00 | | 41,600.00 | - | - | 3,120.00 | 3,120.00 | 38,480.00 | - |
| | Project Assets | | 27,62,966.00 | | | 11,84,720.00 | 15,78,246.00 | 15,37,023.36 | 1,83,891.40 | - | 17,20,914.76 | (1,42,668.76) | 12,25,942.64 |
| | **TOTAL (K)** | | **3,58,63,990.12** | **46,51,340.00** | **7,21,813.00** | **11,84,720.00** | **4,00,52,423.12** | **93,57,399.28** | **46,73,689.63** | **54,135.98** | **1,40,85,224.88** | **2,59,67,198.24** | **2,65,06,590.84** |
| | **TOTAL OF CURRENT YEAR (1)** | | **2,72,17,13,944.59** | **6,03,74,893.00** | **6,04,51,317.26** | **11,84,720.00** | **2,84,13,55,434.85** | **1,72,08,95,924.71** | **13,83,53,390.80** | **40,15,821.66** | **1,86,32,65,137.17** | **97,80,90,297.68** | **1,00,08,18,019.88** |
| | **TOTAL OF PREVIOUS YEAR (1)** | | **2,46,64,98,668.59** | **4,06,99,528.00** | **6,37,83,514.00** | - | **2,57,09,81,710.59** | **1,42,20,92,444.29** | **14,15,20,149.38** | **66,63,379.38** | **1,57,27,12,395.96** | **99,82,69,314.63** | **1,04,44,06,224.30** |
| 2 | **CAPITAL WORK-IN-PROGRESS** | | | | | | | | | | | | |
| A | Advance-CWIP (Const Devasthal) | | 17,68,60,420.00 | 28,74,175.00 | 6,00,000.00 | | 18,03,34,595.00 | - | | | - | 18,03,34,595.00 | 17,68,60,420.00 |
| B | Astro Park and Science Centre | | 10,93,880.00 | - | - | | 10,93,880.00 | - | | | - | 10,93,880.00 | 10,93,880.00 |
| | **TOTAL (2)** | | **17,79,54,300.00** | **28,74,175.00** | **6,00,000.00** | - | **18,14,28,475.00** | - | - | - | - | **18,14,28,475.00** | **17,79,54,300.00** |
| | **GRAND TOTAL (1 + 2)** | | **2,89,96,68,244.59** | 6,32,49,068.00 | 6,10,51,317.26 | 11,84,720.00 | **3,02,27,83,909.85** | **1,72,08,95,924.71** | **13,83,53,390.80** | **40,15,821.66** | **1,86,32,65,137.17** | **1,15,95,18,772.68** | **1,17,87,72,319.88** |

Annexed to the Balance Sheet of even date attached.

For R.S.KAFALTIYA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. RAMA SHANKAR KAFALTIYA, FCA
PROPRIETOR
[FRN - 024191C]
[MRN - 411796]
PLACE : HALDWANI
DATED : September 24, 2025

R S KAFALTIYA & ASSOCIATES * HALDWANI * Chartered Accountants FRN:024191C

For and on behalf of ARIES, Nainital

(REGISTRAR) (DIRECTOR)

ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
MANORA PEAK, NAINITAL

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st March 2025

| | SCHEDULE 9 - INVESTMENTS FROM EARMARKED/ENDOWMENT FUNDS | | (Amount in "INR") |
|---|---|---|---|
| S.NO | PARTICUALRS | Current Year For the year ended 31st March 2025 (Debit) | Previous Year For the year ended 31st March 2024 (Debit) |
| 1 | In Government Securities | - | - |
| 2 | Other approved Securities | - | - |
| 3 | Shares | - | - |
| 4 | Debentures and Bonds | - | - |
| 5 | Subsidiaries and joint Ventures | - | - |
| 6 | **Others (to be specified):** | | |
| | a) FDR (GPF A/C) with Scheduled Bank (SBI) | 3,35,16,937.00 | 3,26,05,958.00 |
| | b) FDR (Pension Fund A/C) with Scheduled Bank (UBI) | - | - |
| | c) Interest Accrued | - | - |
| | TOTAL | 3,35,16,937.00 | 3,26,05,958.00 |

| | SCHEDULE 10 - INVESTMENTS - OTHERS | | |
|---|---|---|---|
| S.NO | PARTICUALRS | Current Year For the year ended 31st March 2025 (Debit) | Current Year For the year ended 31st March 2024 (Debit) |
| 1 | In Government Securities | - | - |
| 2 | Other approved Securities | - | - |
| 3 | Shares | - | - |
| 4 | Debentures and Bonds | - | - |
| 5 | Subsidiaries and Joint Ventures | - | - |
| 6 | **Others (to be specified):** | | |
| | FDR (ST RADAR Project) with Scheduled Bank (SBI) | 27,05,948.00 | 25,75,930.00 |
| | TOTAL | 27,05,948.00 | 25,75,930.00 |

Annexed to the Balance Sheet of even date attached.

For R.S.KAFALTIYA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. RAMA SHANKAR KAFALTIYA, FCA
PROPRIETOR
[FRN - 024191C]
[MRN - 411796]

PLACE : HALDWANI
DATED : September 24, 2025

R S KAFALTIYA & ASSOCIATES Chartered Accountants FRN:024191C *HALDWANI*

For and on behalf of ARIES, Nainital

(REGISTRAR) (DIRECTOR)

ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
MANORA PEAK, NAINITAL

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st March 2025

| | SCHEDULE 11 (A) - CURRENT ASSETS, LOANS, ADVANCES ETC. | | | | (Amount in "INR") |
|---|---|---|---|---|---|
| S.NO | PARTICUALRS | Current Year For the year ended 31st March 2025 | | Previous Year For the year ended 31st March 2024 | |
| | | (Debit) | (Debit) | (Debit) | (Debit) |
| | A. CURRENT ASSETS | | | | |
| 1 | Inventories: | | | | |
| | a) Finished Goods | | - | | - |
| | b) Work in Progress | | - | | - |
| | c) Consumables | | | | |
| | -Stores and Spares | 14,40,761.62 | | 17,10,361.22 | |
| | -Stationary | 4,83,572.81 | | 2,66,907.41 | |
| | -Computer Accessories | 7,74,662.20 | | 8,63,877.20 | |
| | -Postage Stamps | 1,746.00 | | 10,039.00 | |
| | -Fuel (POL) | 8,07,327.30 | 35,08,069.93 | 7,59,005.52 | 36,10,190.35 |
| 2 | Sundry Debtors: | | | | |
| | a) Debts Outstanding > six months | - | | - | |
| | b) Others | - | - | - | - |
| 3 | Cash balances in hand (including cheques/drafts) | | - | | - |
| 4 | Bank Balances: | | | | |
| | a) With Scheduled Banks: | | | | |
| | Current Accounts | - | | - | |
| | Deposit Accounts (LC) | 41,72,074.00 | | 39,00,032.00 | |
| | Savings Account * | | | | |
| | -Director A/C | 5,68,82,742.80 | | 8,44,42,752.74 | |
| | -Pension Fund A/C | 6,74,94,320.70 | | 7,25,65,948.72 | |
| | -GPF A/C | 50,06,187.30 | | 1,26,87,536.30 | |
| | -Canteen A/C | 2,21,726.99 | | 2,15,851.99 | |
| | -Staff Welfare Fund A/C | 5,27,794.00 | | 3,80,009.00 | |
| | -Project Bank A/Cs | 58,77,984.49 | 14,01,82,830.28 | 74,64,024.49 | 18,16,56,155.24 |
| | b) With Non-Scheduled Banks: | | - | | - |
| 5 | Post Office-Savings Accounts | | - | | - |
| | TOTAL (A) | | 14,36,90,900.21 | | 18,52,66,345.59 |

* Separate List Attached.

Annexed to the Balance Sheet of even date attached.

For R.S.KAFALTIYA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. RAMA SHANKAR KAFALTIYA, FCA
PROPRIETOR
[FRN - 024191C]
[MRN - 411796]

R S KAFALTIYA & ASSOCIATES Chartered Accountants FRN:024191C HALDWANI

PLACE : HALDWANI
DATED : September 24, 2025

For and on behalf of ARIES, Nainital

(REGISTRAR)

(DIRECTOR)

ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
MANORA PEAK, NAINITAL

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st March 2025

| S.NO | SCHEDULE 11 (B) - CURRENT ASSETS, LOANS, ADVANCES ETC. | | | (Amount in "INR") | |
|---|---|---|---|---|---|
| | PARTICUALRS | Current Year For the year ended 31st March 2025 | | Previous Year For the year ended 31st March 2024 | |
| | | (Debit) | (Debit) | (Debit) | (Debit) |
| | **B. Loans, Advances & Other Assets** | | | | |
| 1 | **Loans:** | | | | |
| | a) Staff | 1,02,41,915.00 | | 79,36,565.00 | |
| | b) Others (specify) | - | 1,02,41,915.00 | - | 79,36,565.00 |
| 2 | **Advances and other amounts** | | | | |
| | (recoverable in cash or in kind) | | | | |
| | a) On Capital Accounts (EE(PWD)) | 7,69,200.00 | | 7,69,200.00 | |
| | b) Pre-paid Expenses | 18,25,653.00 | | 14,91,802.00 | |
| | c) Extraneous Debits* | 21,05,001.20 | | 3,91,921.00 | |
| | d) TDS receivables | 16,44,940.00 | | 10,13,122.00 | |
| | e) Security Deposit | 54,212.00 | | 54,212.00 | |
| | f) DST Research and Development | 18,90,483.00 | | 18,90,483.00 | |
| | g) Meeting Advance (IUSSTF Award) | 2,53,206.29 | | 2,53,206.29 | |
| | h) Income Tax Deposit | 92,40,698.00 | 1,77,83,393.49 | 92,40,698.00 | 1,51,04,644.29 |
| 3 | **Income Accured On:** | | | | |
| | a) Investments - Endowment Funds | | | | |
| | i) FDR Interest (GPF A/C) | 6,53,182.00 | | 5,23,735.00 | |
| | ii) FDR Interest (Pension Fund A/C) | 24,64,563.00 | 31,17,745.00 | 25,29,485.00 | 30,53,220.00 |
| | b) Investments - Others | | | | |
| | i) FDR Interest (ST RADAR Project) | 64,828.00 | | 52,778.00 | |
| | ii) FDR Interest (ISRO Project) | - | 64,828.00 | - | 52,778.00 |
| | c) Loans and Advances | 48,427.00 | 48,427.00 | 48,427.00 | 48,427.00 |
| | d) Others (Specify):- | | | | |
| | i) Interest on Saving Bank A/Cs | 64,85,106.00 | 64,85,106.00 | 64,84,720.00 | 64,84,720.00 |
| 4 | **Claims Receivable** | - | - | - | - |
| | TOTAL (B) | | 3,77,41,414.49 | | 3,26,80,354.29 |
| | | | | | |
| | TOTAL (A+B) | | 18,14,32,314.70 | | 21,79,46,699.88 |

*As Per Separate List Attached

Annexed to the Balance Sheet of even date attached.

For R.S.KAFALTIYA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. RAMA SHANKAR KAFALTIYA, FCA
PROPRIETOR
[FRN - 024191C]
[MRN - 411796]

PLACE : HALDWANI
DATED : September 24, 2025

R S KAFALTIYA & ASSOCIATES Chartered Accountants FRN:024191C *HALDWANI*

For and on behalf of ARIES, Nainital

(REGISTRAR) (DIRECTOR)

ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
MANORA PEAK, NAINITAL

SCHEDULES FORMING PART OF INCOME & EXPENDITURE FOR THE YEAR ENDED 31st March 2025

| | SCHEDULE 12 - INCOME FROM SALES/SERVICES | | (Amount in "INR") |
|---|---|---|---|
| S.NO | PARTICUALRS | Current Year<br>For the year ended 31st March 2025<br>(Credit) | Previous Year<br>For the year ended 31st March 2024<br>(Credit) |
| 1 | Income from Sales | | |
| | a) Sale of Finished Goods | - | - |
| | b) Sale of Raw Material | - | - |
| | c) Sale of Scraps | 7,00,887.00 | - |
| 2 | Income from Services | | |
| | a) Labour and Processing Charges | - | - |
| | b) Professional/ Consultancy Services | - | - |
| | c) Agency Commission and Brokerage | - | - |
| | d)Maintenance Servies ( Equipment/ Property) | - | - |
| | e) Others (Specify) | - | - |
| | TOTAL | 7,00,887.00 | - |

| | SCHEDULE 13 - GRANTS/SUBSIDIES | | (Amount in "INR") |
|---|---|---|---|
| S.NO | PARTICUALRS | Current Year<br>For the year ended 31st March 2025<br>(Credit) | Previous Year<br>For the year ended 31st March 2024<br>(Credit) |
| 1 | Central Government Grants: | | |
| | -Grant in aid "General" | 14,88,00,000.00 | 14,44,00,000.00 |
| | -Grant in aid "Salary" | 14,44,37,462.00 | 17,48,56,025.00 |
| 2 | State Government Grants | - | - |
| 3 | Government Agencies | - | - |
| 4 | Others ( specify) | - | - |
| | TOTAL | 29,32,37,462.00 | 31,92,56,025.00 |

Annexed to the Statement of Income & Expenditure
of even date attached herewith.

For R.S.KAFALTIYA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. RAMA SHANKAR KAFALTIYA, FCA
PROPRIETOR
[FRN - 024191C]
[MRN - 411796]

R S KAFALTIYA & ASSOCIATES Chartered Accountants FRN:024191C HALDWANI

PLACE : HALDWANI
DATED : September 24, 2025

For and on behalf of ARIES, Nainital

(REGISTRAR)

(DIRECTOR)

ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
MANORA PEAK, NAINITAL

SCHEDULES FORMING PART OF INCOME & EXPENDITURE FOR THE YEAR ENDED 31st March 2025

| | SCHEDULE 14 - FEES/SUBSCRIPTIONS | | (Amount in "INR") |
|---|---|---|---|
| S.NO | PARTICUALRS | Current Year<br>For the year ended 31st March 2025<br>(Credit) | Previous Year<br>For the year ended 31st March 2024<br>(Credit) |
| 1 | Entrance Fees | - | - |
| 2 | Annual Fees/ Subscriptions | - | - |
| 3 | Seminar/ Programe Fees | - | - |
| 4 | Consultancy Fees | - | - |
| 5 | Others (Specify) | - | - |
| | TOTAL | - | - |

Annexed to the Statement of Income & Expenditure
of even date attached herewith.

For R.S.KAFALTIYA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. RAMA SHANKAR KAFALTIYA, FCA
PROPRIETOR
[FRN - 024191C]
[MRN - 411796]

PLACE : HALDWANI
DATED : September 24, 2025

R S KAFALTIYA & ASSOCIATES Chartered Accountants FRN:024191C HALDWANI

For and on behalf of ARIES, Nainital

(REGISTRAR) (DIRECTOR)

# ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
## MANORA PEAK, NAINITAL

SCHEDULES FORMING PART OF INCOME & EXPENDITURE FOR THE YEAR ENDED 31st March 2025

| | SCHEDULE 15 - INCOME FROM INVESTMENTS | | | | | | (Amount in "INR") |
|---|---|---|---|---|---|---|---|
| S.NO | PARTICUALRS | Investment from Earmarked Fund | | Investment - Others | | Total | |
| | | Current Year | Previous Year | Current Year | Previous Year | Current Year | Previous Year |
| | | For the year ended 31st March 2025 | For the year ended 31st March 2024 | For the year ended 31st March 2025 | For the year ended 31st March 2024 | For the year ended 31st March 2025 | For the year ended 31st March 2024 |
| | | (Credit) | (Credit) | (Credit) | (Credit) | (Credit) | (Credit) |
| 1 | Interest | - | - | - | - | - | - |
| 2 | Dividends: | - | - | - | - | - | - |
| 3 | Rents | - | - | - | - | - | - |
| 4 | **Others (Specify)** | | | | | - | - |
| | -Interest on FDR (GPF A/C) | 11,56,033.00 | 10,60,052.00 | - | - | 11,56,033.00 | 10,60,052.00 |
| | -Interest on FDR (Pension Fund A/C) | | - | - | - | - | - |
| | -Interest on FDR (ISRO Project A/C) | - | 48,711.00 | - | - | - | 48,711.00 |
| | -Interest on FDR (ST RADAR Project) | 1,57,856.00 | 1,34,082.00 | - | - | 1,57,856.00 | 1,34,082.00 |
| | TOTAL | 13,13,889.00 | 12,42,845.00 | - | - | 13,13,889.00 | 12,42,845.00 |
| | TRANSFFRRED TO INVESTMENTS | 13,13,889.00 | 12,42,845.00 | - | - | 13,13,889.00 | 12,42,845.00 |

Annexed to the Statement of Income & Expenditure
of even date attached herewith.

For R.S.KAFALTIYA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. RAMA SHANKAR KAFALTIYA, FCA
PROPRIETOR
[FRN - 024191C]
[MRN - 411796]

R S KAFALTIYA & ASSOCIATES * HALDWANI * Chartered Accountants FRN:024191C

PLACE : HALDWANI
DATED : September 24, 2025

For and on behalf of ARIES, Nainital

(REGISTRAR) (DIRECTOR)

## ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
## MANORA PEAK, NAINITAL

### SCHEDULES FORMING PART OF INCOME & EXPENDITURE FOR THE YEAR ENDED 31st March 2025

| | SCHEDULE 16 - INCOME FROM ROYALTY, PUBLICATION ETC. | | | (Amount in "INR") | |
|---|---|---|---|---|---|
| S.NO | PARTICUALRS | Current Year<br>For the year ended<br>31st March 2025 | | Previous Year<br>For the year ended<br>31st March 2024 | |
| 1 | Income from Royalty | - | - | - | - |
| 2 | Income from Publications | - | - | - | - |
| 3 | Others (specify) | - | - | - | - |
| | TOTAL | - | - | - | - |

| | SCHEDULE 17 - INTEREST EARNED | | | (Amount in "INR") | |
|---|---|---|---|---|---|
| S.NO | PARTICUALRS | Current Year<br>For the year ended<br>31st March 2025 | | Previous Year<br>For the year ended<br>31st March 2024 | |
| 1 | **On Term Deposits:** | | | | |
| | a) With Scheduled Banks (Separately shown as Income from Investments) | - | | - | |
| | b) With Non-Scheduled Banks | - | | - | |
| | c) Others | - | - | - | - |
| 2 | **On Savings Accounts:** | | | | |
| | **a) With Scheduled Banks** | | | | |
| | -GPF A/C (SBI - 300) | 2,80,326.00 | | 3,12,122.00 | |
| | -Pension Fund A/C (SBI - 311) | 642.00 | | 252.00 | |
| | -Pension Fund A/C (UBI - 535) | 20,120.00 | | 21,031.00 | |
| | -Pension Fund A/C (SBI - 253) | 50,04,211.00 | | 46,16,678.00 | |
| | -Canteen Bank A/Cs | 5,878.00 | | 5,746.00 | |
| | b) With Non-Scheduled Banks | - | | - | |
| | c) Others | - | 53,11,177.00 | - | 49,55,829.00 |
| 3 | **On Loans:** | | | | |
| | **a) Employees/Staff** | | | | |
| | -HBA Interest | 4,15,124.00 | | 3,67,089.00 | |
| | -Car Advance Interest | 81,960.00 | | 91,790.00 | |
| | -Computer Advance Interest | 46,136.00 | | 72,631.00 | |
| | -M.Cycle Advance Interest | - | 5,43,220.00 | 4,363.00 | 5,35,873.00 |
| | b) Others - Intt on Income Tax Refund | | - | | - |
| | TOTAL | | 58,54,397.00 | | 54,91,702.00 |

Annexed to the Statement of Income & Expenditure
of even date attached herewith.

For R.S.KAFALTIYA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. RAMA SHANKAR KAFALTIYA, FCA
PROPRIETOR
[FRN - 024191C]
[MRN - 411796]

R S KAFALTIYA & ASSOCIATES * HALDWANI * Chartered Accountants FRN:024191C

PLACE : HALDWANI
DATED : September 24, 2025

For and on behalf of ARIES, Nainital

(REGISTRAR) (DIRECTOR)

ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
MANORA PEAK, NAINITAL

SCHEDULES FORMING PART OF INCOME & EXPENDITURE FOR THE YEAR ENDED 31st March 2025

| | SCHEDULE 18 - OTHER INCOMES | | | (Amount in "INR") | |
|---|---|---|---|---|---|
| S.NO | PARTICUALRS | Current Year<br>For the year ended<br>31st March 2025 | | Previous Year<br>For the year ended<br>31st March 2024 | |
| | | (Credit) | (Credit) | (Credit) | (Credit) |
| 1 | Profit on Sale/disposal of Assets | - | - | - | - |
| 2 | Export Incentives realized | - | - | - | - |
| 3 | **Fees for Miscellaneous Services:** | | | | |
| | a) Electricity Charges | 4,74,053.00 | | 4,67,942.00 | |
| | b) Medical Contribution | 12,21,000.00 | | 8,90,450.00 | |
| | c) Water Charges | 1,73,822.00 | | 1,81,973.00 | |
| | d) House License Fees | 7,76,024.00 | 26,44,899.00 | 6,37,855.00 | 21,78,220.00 |
| 4 | **Miscellaneous Income:** | | | | |
| | a) EMD Security Forfeited & LD | 6,61,818.00 | | 2,07,610.00 | |
| | b) Project Overhead Charges | 5,01,771.00 | | 11,44,682.00 | |
| | c) RTI Receipts | 58.00 | | 6,268.00 | |
| | d) Canteen, Guest House and Hostel R | 52,77,488.08 | | 49,36,031.00 | |
| | e) Tuition Fee Recovery | 1,92,000.00 | | 2,32,000.00 | |
| | f) Recruitment Fee | - | | 7,500.00 | |
| | g) Travel Grant | 58,012.00 | | - | |
| | h) Other Incomes | 5,69,836.80 | | 4,72,104.00 | |
| | i) Recovery of TA Advance | | 72,60,983.88 | - | 70,06,195.00 |
| | TOTAL | | 99,05,882.88 | | 91,84,415.00 |

Annexed to the Statement of Income & Expenditure
of even date attached herewith.

For R.S.KAFALTIYA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. RAMA SHANKAR KAFALTIYA, FCA
PROPRIETOR
[FRN - 024191C]
[MRN - 411796]

PLACE : HALDWANI
DATED : September 24, 2025

R S KAFALTIYA & ASSOCIATES Chartered Accountants FRN:024191C HALDWANI

For and on behalf of ARIES, Nainital

(REGISTRAR) (DIRECTOR)

ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
MANORA PEAK, NAINITAL

SCHEDULES FORMING PART OF INCOME & EXPENDITURE FOR THE YEAR ENDED 31st March 2025

| | SCHEDULE 19 - INCREASE/(DECREASE) IN INVENTORIES | | | | (Amount in "INR") |
|---|---|---|---|---|---|
| S.NO | PARTICUALRS | Current Year | | Previous Year | |
| | | For the year ended 31st March 2025 | | For the year ended 31st March 2024 | |
| | | (Credit) | (Credit) | (Credit) | (Credit) |
| 1 | Closing stock | | | | |
| | -Finished Goods | - | | - | |
| | -Work-in-progress | - | | - | |
| | -Consumables | 35,08,069.93 | 35,08,069.93 | 36,10,190.35 | 36,10,190.35 |
| 2 | Less: Opening Stock | | | | |
| | -Finished Goods | - | | - | |
| | -Work-in-progress | - | | - | |
| | -Consumables | 36,10,190.35 | 36,10,190.35 | 31,78,109.00 | 31,78,109.00 |
| | NET INCREASE/(DECREASE) [1-2] | | (1,02,120.42) | | 4,32,081.35 |

Annexed to the Statement of Income & Expenditure
of even date attached herewith.

For R.S.KAFALTIYA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. RAMA SHANKAR KAFALTIYA, FCA
PROPRIETOR
[FRN - 024191C]
[MRN - 411796]

PLACE : HALDWANI
DATED : September 24, 2025

R S KAFALTIYA & ASSOCIATES Chartered Accountants FRN:024191C HALDWANI

For and on behalf of ARIES, Nainital

(REGISTRAR) (DIRECTOR)

ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
MANORA PEAK, NAINITAL

SCHEDULES FORMING PART OF INCOME & EXPENDITURE FOR THE YEAR ENDED 31/03/2025

| | SCHEDULE 20 - ESTABLISHMENT EXPENSES | | (Amount in "INR") |
|---|---|---|---|
| S.NO | PARTICUALRS | Current Year<br>For the year ended 31st March 2025<br>(Debit) | Previous Year<br>For the year ended 31st March 2024<br>(Debit) |
| 1 | Salaries and Wages | 10,95,49,837.00 | 10,52,15,887.00 |
| 2 | Allowances and Bonus | 4,91,62,840.00 | 4,25,31,434.00 |
| 3 | Contribution to NPS | 1,31,83,137.00 | 1,22,09,249.00 |
| 4 | Others (specify) | | |
| | -Medical Expenses | 57,38,258.00 | 51,23,852.00 |
| | -Fellowship | 2,88,06,621.00 | 2,62,13,082.00 |
| | -Leave Encashment | 53,45,708.00 | 62,28,268.00 |
| | -Leave Travel Concession | 12,86,246.00 | 11,02,843.00 |
| | - Gratuity Expenses | 83,48,854.00 | 46,45,039.00 |
| | -Reimbursement of Tuition Fees | 25,97,090.00 | 2,43,000.00 |
| 5 | Prior Period Expenses | | |
| | -Leave Encashment (Prior Period) | - | 54,97,517.00 |
| | - Gratuity Expenses (Prior Period) | - | 52,69,768.00 |
| | TOTAL | 22,40,18,591.00 | 21,42,79,939.00 |

Annexed to the Statement of Income & Expenditure
of even date attached herewith.

For R.S.KAFALTIYA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. RAMA SHANKAR KAFALTIYA, FCA
PROPRIETOR
[FRN - 024191C]
[MRN - 411796]

R S KAFALTIYA & ASSOCIATES Chartered Accountants FRN:024191C HALDWANI

PLACE : HALDWANI
DATED : September 24, 2025

For and on behalf of ARIES, Nainital

(REGISTRAR) (DIRECTOR)

ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
MANORA PEAK, NAINITAL

SCHEDULES FORMING PART OF INCOME & EXPENDITURE FOR THE YEAR ENDED 31st March 2025

| | SCHEDULE 21 - OTHER ADMINISTRATIVE EXPENSES | | (Amount in "INR") |
|---|---|---|---|
| S.NO | PARTICUALRS | Current Year<br>For the year ended<br>31st March 2025<br>(Debit) | Previous Year<br>For the year ended<br>31st March 2024<br>(Debit) |
| 1 | Repair & Maintenance | 1,00,83,963.00 | 1,51,93,219.00 |
| 2 | Consumable Expenses | 56,38,031.00 | 1,11,87,273.00 |
| 3 | Other Administrative Expenses * | 1,35,40,395.00 | 1,43,48,302.00 |
| 4 | Meeting Expenses * | 32,78,834.00 | 29,21,797.00 |
| 5 | Advertisement Expenses | 61,171.00 | 7,12,702.00 |
| 6 | AMC Expenses | 21,04,177.00 | 15,21,797.00 |
| 7 | ASTRAD Annual License Fee | 7,18,531.00 | 7,03,715.76 |
| 8 | Audit Fees | 45,000.00 | 60,930.00 |
| 9 | Bank Charges | 9,909.87 | 1,57,145.34 |
| 10 | BSNL Lease Rent | 26,41,270.00 | 15,23,181.00 |
| 11 | Cleaning Work Expenses | 3,84,316.00 | 59,493.00 |
| 12 | Consultancy/IISF Expo/ILMT Hiring / Training | 70,799.00 | 38,23,593.00 |
| 13 | Conveyance Expenses | 26,42,950.00 | 25,99,495.00 |
| 14 | Custom Duty / Custom Clearance Charges | - | 15,17,961.00 |
| 15 | Dispensary Expenses | 6,000.00 | 28,481.00 |
| 16 | Electricity Expenses | 98,98,342.00 | 85,83,823.00 |
| 17 | Freight & Cartage | 35,214.00 | 14,634.00 |
| 18 | Hospitality Expenses | 35,454.00 | - |
| 19 | Insurance Charges | 82,941.00 | 1,82,123.32 |
| 20 | Legal Fee / Professional Fee/ Consultance Charges | 7,76,250.00 | 5,12,010.00 |
| 21 | Library Expenses (Journals) | 21,68,810.72 | 35,83,041.22 |
| 22 | Licence Fee Renewal (ILMT) | - | 1,93,576.00 |
| 23 | Manpower Expenses | 4,13,93,216.00 | 2,88,11,983.00 |
| 24 | Office Expenses | 14,08,028.00 | 2,64,369.00 |
| 25 | POL (Fuel) Expenses | 39,92,203.00 | 39,48,518.00 |
| 26 | Printing & Stationary Expenses | 7,54,315.00 | 2,45,544.00 |
| 27 | Registration Expenses | 50,578.00 | 3,27,059.00 |
| 28 | Telephone Expenses | 4,85,300.00 | 4,40,013.00 |
| 29 | Travelling Expenses | 61,21,023.00 | 89,91,407.91 |
| 30 | Workshop Expenses | 5,18,885.00 | 3,30,418.00 |
| | TOTAL | 10,89,45,906.59 | 11,27,87,604.55 |

*As per separate list attached.

Annexed to the Statement of Income & Expenditure
of even date attached herewith.

For R.S.KAFALTIYA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. RAMA SHANKAR KAFALTIYA, FCA
PROPRIETOR
[FRN - 024191C]
[MRN - 411796]

PLACE : HALDWANI
DATED : September 24, 2025

For and on behalf of ARIES, Nainital

(REGISTRAR) (DIRECTOR)

ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
MANORA PEAK, NAINITAL

SCHEDULES FORMING PART OF INCOME & EXPENDITURE FOR THE YEAR ENDED 31st March 2025

| S.NO | SCHEDULE 22 - EXPENDITURE ON GRANTS | | (Amount in "INR") |
|---|---|---|---|
| | PARTICUALRS | Current Year<br>For the year ended 31st March 2025<br>(Debit) | Previous Year<br>For the year ended 31st March 2024<br>(Debit) |
| 1 | Grant given to Institutions | - | - |
| 2 | Subsidies given to Institutions | - | - |
| | TOTAL | - | - |

| S.NO | SCHEDULE 23 - INTEREST EXPENDITURES | | (Amount in "INR") |
|---|---|---|---|
| | PARTICUALRS | Current Year<br>For the year ended 31st March 2025<br>(Debit) | Previous Year<br>For the year ended 31st March 2024<br>(Debit) |
| 1 | On Fixed Loans | - | - |
| 2 | On Other Loans (including Bank Charges) | - | - |
| 3 | Others (specify) | - | - |
| | -Interest accrued on GPF A/C | 33,03,466.00 | 37,38,096.00 |
| | TOTAL | 33,03,466.00 | 37,38,096.00 |

Annexed to the Statement of Income & Expenditure
of even date attached herewith.

For R.S.KAFALTIYA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. RAMA SHANKAR KAFALTIYA, FCA
PROPRIETOR
[FRN - 024191C]
[MRN - 411796]

PLACE : HALDWANI
DATED : September 24, 2025

R S KAFALTIYA & ASSOCIATES Chartered Accountants FRN:024191C HALDWANI

For and on behalf of ARIES, Nainital

(REGISTRAR) (DIRECTOR)

ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
MANORA PEAK, NAINITAL

ANNEXURE OF SCH 11(A)(4): LIST OF BANK ACCOUNTS AS ON 31.03.2025

(Amount in "INR")

| S. NO. | PARTICULARS | Current Year For the year ended 31st March 2025 | Previous Year For the year ended 31st March 2024 |
|---|---|---|---|
| | | Debit | Debit |
| 1 | Director's (SBI) Bank A/C 10860840253 & MoD | 5,68,82,742.80 | 8,44,42,752.74 |
| 2 | Director's RBI Director Account No. 10695601013 | - | - |
| 3 | GPF (SBI) A/C 10860840300 | 50,06,187.30 | 1,26,87,536.30 |
| 4 | SBI (Canteen) Bank A/C 32320085086 | 2,21,726.99 | 2,15,851.99 |
| 5 | SBI (Staff Welfare Fund) Bank A/C - 39589660093 | 5,27,794.00 | 3,80,009.00 |
| 6 | LC Account No 00000041084215005 | 41,72,074.00 | 39,00,032.00 |
| 7 | **Pension Fund A/Cs:** | | |
| | Pension Fund (SBI) A/C - 10860840311 &MoD | 6,74,94,320.70 | 7,17,87,942.70 |
| | Pension Fund (UBI) A/C - 534702010000535 | - | 7,78,006.02 |
| | Total (7) | 6,74,94,320.70 | 7,25,65,948.72 |
| 8 | **Project Bank A/Cs** | | |
| | SBI (ISRO-GBP-ARFI) Bank A/C 30192927780 | 1,345.00 | 1,309.00 |
| | SBI (ISRO ATCTM Project) Bank A/C 30310168038 | 1,32,555.54 | 7,82,645.54 |
| | SBI (ISRO-GBP-ABLN & C) Bank A/C 30318931302 | 12,79,076.00 | 21,82,580.00 |
| | SBI (ST RADAR Project) Bank A/C 30357703902 | 23,35,007.00 | 22,73,139.00 |
| | SBI (Thai Project) Bank A/C 38832273131 | 121.50 | 94,363.50 |
| | UCO (UCOST Project) BANK A/C 28720110011577 | 81.45 | 78.45 |
| | SBI (Project A/c ) 00000040993525190 | - | 7,714.50 |
| | SBI (Project A/c)41079416912 | - | 25,125.50 |
| | SBI Bank A/c SERB/SRS/113 42557691842 | 8,04,236.00 | 6,15,894.00 |
| | SBI Project A/c (42482471194) | 4,33,741.00 | 4,43,755.00 |
| | SBI Project A/c (42719584862) | 8,90,445.00 | 9,60,107.00 |
| | SBI SERB NPDF Account No. 42482475892 | 1,376.00 | 77,313.00 |
| | Total (8) | 58,77,984.49 | 74,64,024.49 |
| | Grand Total (1+2+3+4+5+6+7+8) | 14,01,82,830.28 | 18,16,56,155.24 |

Annexed to Sch 11(A)(4) of the Balance Sheet of even date attached.

For R.S.KAFALTIYA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. RAMA SHANKAR KAFALTIYA, FCA
PROPRIETOR
[FRN - 024191C]
[MRN - 411796]

R S KAFALTIYA & ASSOCIATES Chartered Accountants FRN:024191C HALDWANI

PLACE : HALDWANI
DATED : September 24, 2025

For and on behalf of ARIES,
Nainital

(REGISTRAR)

(DIRECTOR)

ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
MANORA PEAK, NAINITAL

ANNEXURE OF SCH 7: LIST OF OUTSTANDING EXPENSES AS ON 31.03.2025

| Sl.No | PARTICULARS | For the year ended 31st March 2025 | For the year ended 31st March 2024 |
|---|---|---|---|
| 1 | Internet service charges | 56,565.00 | 77,802.00 |
| 2 | Audit Fee | 45,000.00 | 45,000.00 |
| 3 | BSNL Lease rent | 1,49,720.00 | - |
| 4 | Canteen Expenses | - | 2,83,743.00 |
| 5 | Contractor Employee Salary | 3,14,145.00 | 1,22,799.00 |
| 6 | Contractual Salary ( UPNL) | 32,307.00 | 5,23,317.00 |
| 7 | Contractual Salary -Jeet Securities | 14,30,950.00 | - |
| 8 | DA | 33,75,729.00 | 32,25,800.00 |
| 9 | DA on TA | 1,27,838.00 | 1,16,775.00 |
| 10 | DA-Arrear | 3,98,193.00 | 5,34,758.00 |
| 11 | E- HRA | 3,03,660.00 | - |
| 12 | Electricity Expense ( Devsthal) April Month Paid | 1,28,444.00 | - |
| 13 | Electricity Expense ( Devsthal) April Month Paid | 24,104.00 | - |
| 14 | Electricity Expense ( Manora Peak) April Month Paid | 1,54,599.00 | - |
| 15 | Electricity Expense ( Manora Peak) April Month Paid | 2,73,852.00 | - |
| 16 | Electricity Expenses (Transit Camp) | 80,053.00 | - |
| 17 | Employees Contribution - NPS | 7,95,469.00 | - |
| 18 | Employer Contribution -NPS | 11,05,648.00 | 10,68,585.00 |
| 19 | Extra work Allowance | 382.00 | 370.00 |
| 20 | Fellowship | 28,65,516.00 | 26,60,419.00 |
| 21 | HRA | 27,888.00 | 2,64,906.00 |
| 22 | Library Expenses | 81,585.00 | - |
| 23 | Manpower Expenses (Aryan Security Services) | - | 5,61,325.00 |
| 24 | NSDL Maintenance Charges | 2,054.00 | 2,092.00 |
| 25 | Pay/salaries | 63,69,300.00 | 64,51,600.00 |
| 26 | Pension Expenses | 24,95,069.00 | 23,73,233.00 |
| 27 | Security Expenses (UPNL) | 6,71,400.00 | 6,72,523.00 |
| 28 | Servitor Intelligence Services (Manpower) | 17,37,206.00 | - |
| 29 | Solar Power Consumption | 14,205.00 | - |
| 30 | TDS Return filing charges | 18,913.00 | - |
| 31 | Telephone Expenses | 7,860.00 | - |
| 32 | Telephone Expenses ( Employees) | 29,972.00 | - |
| 33 | Transport Allowance | 2,41,200.00 | 2,33,550.00 |
| 34 | Wages | 1,23,772.00 | - |
| 35 | Water expense | 1,180.00 | - |
| | | 2,34,83,778.00 | 1,92,18,597.00 |

Annexed to Sch 7 of the Balance Sheet of even date attached.

For R.S.KAFALTIYA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. RAMA SHANKAR KAFALTIYA, FCA
PROPRIETOR
[FRN - 024191C]
[MRN - 411796]

PLACE : HALDWANI
DATED : September 24, 2025

R S KAFALTIYA & ASSOCIATES Chartered Accountants FRN:024191C HALDWANI

For and on behalf of ARIES,
Nainital

(REGISTRAR)

(DIRECTOR)

ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
MANORA PEAK, NAINITAL

ANNEXURE OF SCH-7 (7) (v): LIST OF EXTRANEOUS CREDITS FOR THE YEAR ENDED 31.03.2025

| Date | Relevant Head of Account | Particular | Current Year | Previous Year |
|---|---|---|---|---|
| | | | For the year ended 31st March 2025 | For the year ended 31st March 2024 |
| 30-03-2023 | SBI (Director) Bank A/C - 10860840253 | Amount Received From Rajesh Madukar Raou Reason Of Collection is not known | 0 | 16923 |
| 31-03-2023 | SBI (Director) Bank A/C - 10860840253 | Difference in Closing Balance of director bank account 253 and associated MODs as per books of accounts of ARIES and Bank Statement. Balances as per bank statement are Account253- 2,14,55,827 and MOD accounts- 6,76,64,350.21 i.e. 8,91,20,177.20 whereas Balane Of these bank accounts as per books of accounts of ARIES is 8,77,38,008.51 (Including MOD) | 1382168.7 | 1382168.7 |
| 13-06-2023 | SBI (Director) Bank A/C - 10860840253 | Being amount received from Science and Engineering Board (TRANSFER NEFT* RBISOPFMS01 *RBI1652310584961 *Science and Engi-) FROM 4697218044300 | 49528 | 49528 |
| 29-09-2023 | SBI (Director) Bank A/C - 10860840253 | Being TRANSFER NEFT* UBIN0566420*001063806210 *BILLS PAYABLE - OTHE Transfer from 4697186044303 | 37500 | 37500 |
| 31-03-2024 | RBI Director account 1013 | Amount received in bank account not recorded in books of accounts (F.Y. 2023-24) | 777695 | 777695 |
| 31-03-2024 | Bank of Maharastra-5293 | Excess remittance to DST in Inspire Projects (Ayushi & Tushar) | 33293 | 33293 |
| 31-03-2024 | SBI Bank account 27780 | Excess remittance to DST in ISRO-GBP-ARFI Project | 91654 | 91654 |
| 16-05-2024 | SBI (Director) Bank A/C - 10860840253 | Not traced yet | 1180 | 0 |
| 13-09-2024 | SBI (Director) Bank A/C - 10860840253 | Not traced yet | 44590 | 0 |
| 21-10-2024 | SBI (Director) Bank A/C - 10860840253 | Not traced yet | 11970 | 0 |
| 06-11-2024 | SBI (Director) Bank A/C - 10860840253 | Not traced yet | 621 | 0 |
| 31-12-2024 | SBI (Director) Bank A/C - 10860840253 | Not traced yet | 7210 | 0 |
| 31-01-2025 | SBI (Director) Bank A/C - 10860840253 | Not traced yet | 7416 | |
| 31-01-2025 | SBI (Director) Bank A/C - 10860840253 | Not traced yet | 2000 | 0 |
| 28-02-2025 | SBI (Director) Bank A/C - 10860840253 | Not traced yet | 7416 | 0 |
| 29-03-2025 | SBI (Director) Bank A/C - 10860840253 | Not traced yet | 8784 | 0 |
| | | Total | 24,63,025.70 | 23,88,761.70 |

Annexed to Schedule 7 (7) (v) of the Balance Sheet

R S KAFALTIYA & ASSOCIATES
Chartered Accountants
FRN:024191C
HALDWANI

ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
MANORA PEAK, NAINITAL

ANNEXURE OF SCH-11 (b) (2) (c): LIST OF EXTRANEOUS DEBITS FOR THE YEAR ENDED 31.03.2025

| Date | Relevant Head of Account | Particular | Current Year | Previous Year |
|---|---|---|---|---|
| | | | For the year ended 31st March 2025 | For the year ended 31st March 2024 |
| 23-09-2022 | SBI (Director) Bank A/C - 10860840253 | Interest earned on ILTP Project account no. 31286509555 was transferred to Bharatkosh. The amount was not shown in opening balance as outstanding payment. | 48,812.00 | 48,812.00 |
| 31-03-2024 | RBI Director account 1013 | Amount paid to various parties not recorded in books (F.Y. 2022-23) | 3,43,109.00 | 3,43,109.00 |
| 01-04-2024 | SBI (ISRO-GBP-ABLN Project) Bank A/C - 30318931302 | Difference in opening balance of bank account as on 01-04-2024 | 50,000.00 | 0.00 |
| 31-12-2024 | FDR (GPF) SBI A/C - 36793953362 | Not traceable | 382.00 | 0.00 |
| 31-01-2025 | FDR (GPF) SBI A/C - 36793953362 | Not traceable | 382.00 | 0.00 |
| 31-03-2025 | SBI (Director) Bank A/C - 10860840253 | Difference in opening balance of Rs. 3576000 (Dr.) of bank account as on 01.04.2023 and Rs. 1913683.80 (Cr.) as on 01-04-2024 | 16,62,316.20 | 0.00 |
| | | Total | 21,05,001.20 | 3,91,921.00 |

Annexed to Schedule SCH-11 (b) (2) (c) of the Balance Sheet

For R.S.KAFALTIYA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. RAMA SHANKAR KAFALTIYA, FCA
PROPRIETOR
[FRN - 024191C]
[MRN - 411796]

PLACE : HALDWANI
DATED : September 24, 2025

R S KAFALTIYA & ASSOCIATES Chartered Accountants FRN:024191C HALDWANI

For and on behalf of ARIES, Nainital

(REGISTRAR)

(DIRECTOR)

ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
MANORA PEAK, NAINITAL

ANNEXURE OF SCH-21 (3): LIST OF OTHER ADMINISTRATIVE EXPENSE FOR THE YEAR ENDED 31.03.2025

| S. NO. | PARTICULARS | Current Year For the year ended 31st March 2025 | Previous Year For the year ended 31st March 2024 |
|---|---|---|---|
| | | DEBIT | DEBIT |
| 1 | Canteen Expenses | 81,43,616.00 | 1,02,94,482.00 |
| 2 | Water Expenses | 12,24,176.00 | 9,43,755.00 |
| 3 | Pest Control Expenses | 2,13,770.00 | 1,59,576.00 |
| 4 | Internet Charges | 20,79,939.00 | 10,81,776.00 |
| 5 | Wages | 8,53,355.00 | 6,12,138.00 |
| 6 | Return Filing Fees - GST/TDS | 89,826.00 | 1,62,750.00 |
| 7 | NPS Service Charges | 8,801.00 | 5,531.00 |
| 8 | Gardening Expenses | 49,420.00 | - |
| 9 | Guest House Expenses | 67,828.00 | 60,758.00 |
| 10 | Academic Expenses | 5,27,326.00 | 4,92,538.00 |
| 11 | Naini Resort (Lease Rent) | 1,66,868.00 | - |
| 12 | Laundry Expenses | 57,027.00 | 29,297.00 |
| 13 | Ph. D. Registration Expenses | | 4,63,760.00 |
| 14 | Internship Expenses | | 0.00 |
| 15 | Postage Expenses | 36,829.00 | 21,040.00 |
| 16 | Constitution Day Celebration Expenses | 6,510.00 | - |
| 17 | LC Opening/extension Charges | | 11,011.00 |
| 18 | Internship expenses | | 10,000.00 |
| 19 | Services Charges | 15,104.00 | (110.00) |
| | Total | 1,35,40,395.00 | 1,43,48,302.00 |

Annexed to Schedule 21 (3) of the Statement of Income & Expenditure of even date attached.

ANNEXURE OF SCH 21 (4): LIST OF MEETING EXPENSES FOR THE YEAR ENDED 31.03.2025

| S. NO. | PARTICULARS | Current Year For the year ended 31st March 2025 | Previous Year For the year ended 31st March 2024 |
|---|---|---|---|
| | | DEBIT | DEBIT |
| 1 | ATSOA 2020 Meeting Expenses | | 58,171.00 |
| 2 | Hindi Program Expenses | 2,72,006.00 | 4,58,118.00 |
| 3 | Public Outreach Programme | 7,83,162.00 | 6,67,809.00 |
| 4 | Scientific Meeting Expenses | 20,48,175.00 | 13,37,699.00 |
| 5 | ASI-2020 Meeting Expenses | 1,75,491.00 | 4,00,000.00 |
| | Total | 32,78,834.00 | 29,21,797.00 |

Annexed to Schedule 21 (4) of the Statement of Income & Expenditure
of even date attached.

For R.S.KAFALTIYA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. RAMA SHANKAR KAFALTIYA, FCA
PROPRIETOR
[FRN - 024191C]
[MRN - 411796]

PLACE : HALDWANI
DATED : September 24, 2025

R S KAFALTIYA & ASSOCIATES Chartered Accountants FRN:024191C HALDWANI

For and on behalf of ARIES, Nainital

(REGISTRAR) (DIRECTOR)

ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCES (ARIES)
MANORA PEAK, NAINITAL
STATEMENT OF RECEIPT AND PAYMENT FOR THE YEAR ENDED 31st MARCH, 2025

| S.No | RECEIPTS | Current Year 2024-2025 | 2024-25 | | PAYMENTS | Current Year 2024-2025 | 2024-25 |
|---|---|---|---|---|---|---|---|
| I | **Opening Balances:** | | | I | **Fixed Assets** | | |
| | a) Bank Balances | 18,16,56,155.24 | | | Buildings | 1,89,57,575.00 | |
| | b) Cash-in Hand | - | 18,16,56,155.24 | | Capital Work-in-Progress | 3,81,37,060.26 | |
| II | **Capital Account** | | | | Computers / Peripherals | 92,98,407.00 | |
| | Capital Fund | | 12,19,00,000.00 | | Electric Installations | 1,89,03,000.00 | |
| III | **Non-current Liabilities** | | | | Furniture & Fixtures | 41,93,371.00 | |
| | Project Funds | 17509043.21 | | | Vehicle | 7,18,000.00 | |
| | Staff Welfare Fund | 3,06,345.00 | | | Library Books | 2,42,954.00 | |
| | Earmarked / Endowment Funds | 50,93,924.00 | 2,29,09,312.21 | | Office Equipments | 3,93,753.00 | |
| IV | **Current Liabilities** | | | | Other Fixed Assets | 53,73,153.00 | |
| | Current Liabilities & Provisions | 1,51,82,043.80 | | | Plants Machineries & Equipments | 2,80,83,112.00 | 12,43,00,385.26 |
| | Statutory Liabilities | 2,44,39,706.00 | 3,96,21,749.80 | II | **Current Assets** | | |
| V | **Investment** | | | | Loans and Advances | 79,07,916.00 | |
| | Investment-Others | | - | | Other Current Assets | 17,12,316.20 | 96,20,232.20 |
| VI | **Current Assets** | | | III | **Current Liabilities** | | |
| | Loans and Advances | 1,02,13,410.00 | | | Current Liabilities & Provisions | 3,35,61,072.00 | |
| | Accrued Interest received | | 1,02,13,410.00 | | Statutory Liabilities | 2,50,08,263.00 | 5,85,69,335.00 |
| VII | **Indirect Incomes** | | | IV | **Investment** | | |
| | Grants/ Subsidies | 31,38,00,000.00 | | | Investments - Endowment Funds | | 764.00 |
| | Interest | 52,11,104.00 | | V | **Non-current Liabilities** | | |
| | Other Incomes | 96,79,291.08 | 32,86,90,395.08 | | Project Funds | 1,25,65,470.00 | |
| VIII | **Indirect Expenses (Recovery)** | | | | Staff Welfare Fund | 1,58,410.00 | |
| | Establishment Expenses | 1,51,73,681.00 | | | Earmarked / Endowment Funds | 1,73,31,075.00 | 3,00,54,955.00 |
| | Other Administrative Expenses | 6,66,133.00 | 1,58,39,814.00 | VI | **Indirect Expenses** | | |
| | | | | | Establishment Expenses | 24,17,69,215.00 | |
| | | | | | Other Administrative Expenses | 9,56,90,862.59 | 33,74,60,077.59 |
| | | | | VI | **Indirect Income** | | |
| | | | | | Grants/ Subsidies | 2,05,62,538.00 | |
| | | | | | Interest Earned | 1,180.00 | |
| | | | | | Other Incomes | 23,363.00 | 2,05,87,081.00 |
| | | | | VII | **Closing Balance** | | |
| | | | | | a) Bank Balances | 14,01,82,830.28 | |
| | | | | | b) Cash-in Hand (Imprest) | - | 14,01,82,830.28 |
| | **Total** | | 72,08,30,836.33 | | **Total** | | 72,08,30,836.33 |

As per our separate Audit Report of even date attached.

For R.S.KAFALTIYA & ASSOCIATES
CHARTERED ACCOUNTANTS

CA. RAMA SHANKAR KAFALTIYA, FCA
PROPRIETOR
[FRN - 024191C]
[MRN - 411796]

PLACE : HALDWANI
DATED : September 24, 2025

R S KAFALTIYA & ASSOCIATES * HALDWANI * Chartered Accountants FRN:024191C

For and on behalf of ARIES, Nainital

(REGISTRAR) (DIRECTOR)

ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCE (ARIES)

MANORA PEAK, NAINITAL

SCHEDULES FORMING PART OF THE ACCOUNTS FOR THE YEAR ENDEN 31ST MARCH 2025

## SCHEDULE 24 – SIGNIFICANT ACCOUNTING POLICIES:

### 1. ACCOUNTING CONVENTION & ACCOUNTING POLICIES:

(a) The financial statements are prepared on the basis of historical cost convention, unless otherwise stated, and on the basis of ACCRUAL method of accounting except for the following: -

(b) Transactions related to various recoveries out of the salary are recorded in the books of accounts on CASH basis as per management's decision.

(c) Transactions related to interest on advances to employees are recorded in the books of accounts on CASH basis as per management's decision.

(d) Transactions related to re-imbursement of telephone expenses to employees are recorded in the books of accounts on CASH basis as per management's decision.

(e) Transactions relating to TDS under the GST laws are recorded in the books of accounts on CASH basis as per management's decision.

(f) Transactions related to Accrual Interest on all the Project Bank accounts (including Director ARIES account) are recorded in the books of accounts on CASH basis as per management's decision; and

(g) Transactions related to all legal expenses related to court cases are recorded in the books of accounts on CASH basis as per management's decision.

### 2. INVENTORY VALUATION:

a) As the Institute is engaged in research activities only and is not engaged in any manufacturing, trading and/or business activities, it does not carry any inventory of finished goods, raw materials etc.

b) Inventories of the Institute consists "Consumable items" only and includes the stock of Stores & Spares, Fuel, Stationery, Computer Accessories and Postage Stamps.

c) Inventories are valued at Cost as per Accounting Policy of the Institute.

d) List of inventories is prepared on the basis of records maintained by the purchase and issue department of the Institute. The inventory is in good condition and is fully usable.

e) All inventories owned by the Institute, wherever located, have been recorded.

f) The physical verification of the Inventory of the Institute as on 31st March 2025 has been completed and recorded in the office record.

### 3. INVESTMENTS:

a) Investments of the Institute consists Fixed Deposits in Scheduled Bank only. Amount of Provident fund and STRADAR Project Fund are deposited in Fixed Deposit Schemes of Scheduled Bank and are shown as Investments in the Balance Sheet.

b) These Investments are valued at cost as per Institute's accounting policy.

c) All the investments, shown in the Balance Sheet, belong to the Institute and they do not include any investments held on behalf of any other persons.

d) The Institute has clear title to all of its investments. There are no charges against the investments of the Institute except those appearing in the records of the Institute.

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4. **PROPERTY, PLANT & EQUIPMENT:**

a) The net book values of Property, Plant & Equipment, at which these are stated in the Balance Sheet of the Institute, are arrived at: -

i. After taking into account all capital expenditure, as additions thereto, but no expenditure being chargeable to revenue;

ii. After eliminating the cost and accumulated depreciation relating to items sold, discarded, demolished or destroyed;

iii. After providing adequate depreciation as per income Tax Act, 1961 on all the Property, Plant & Equipment of the Institute as the year-end;

iv. After taking into account all capital work-in-progress on completion of the related work; and

v. After making necessary adjustments to present a true and fair view of Property, Plant & Equipment.

b) The Institute is in the process of strengthening its fixed asset management system and intends to develop and maintain a comprehensive Fixed Asset Register in line with the provisions of GFRs to ensure proper control and compliance going forward.

5. **DEPRECIATION:**

a) Depreciation is provided on "**Written Down Value**" method as per rates specifies in the Income-tax Act, 1961 except depreciation on cost adjustments arising on account of conversion of foreign currency liabilities for acquisition of fixed assets, which is amortized over the residual life of the respective assets.

b) In respect of additions to/deduction from fixed assets during the year, depreciation is considered as per income tax rules and not on pro-rata basis.

6. **MISCELLANEOUS EXPENDITURE:**

The Institute has the policy to write-off the Deferred Revenue Expenditure over a period of 5 year from the year it is incurred.

7. **GOVERNMENT GRANTS/SUBSIDIES:**

a) Institutes gets Grants from Central Government to meet out its all financial costs and to complete some related projects.

b) Institute gets Government grants to meet out Capital Expenses, Establishment Expenses, and General Expenses and to complete some relevant Projects.

c) Government grants received to meet out Capital Expenditure are treated as Capital Fund and all the expenditures of capital nature are meet out from this fund.

d) Government grants received for revenue Expenditure e.g. Establishment Expenses and General Expenditure are used to meet out these expenses and the balance of the Grant (Surplus/Deficit) is transferred to Reserves & Surplus A/C.

e) Government grants/subsidies are accounted for on realization basis.

8. **FOREIGN CURRENCY TRANSACTION**

a) Transaction denominated in foreign currency are accounted at the exchange rate prevailing at the date of the transaction.

b) Current asset, foreign currency loans and current liabilities are converted at the exchange rate prevailing as at the year end and the resultant gain/loss is adjusted to cost of fixed assets, if the foreign currency liability relates to fixed assets, and in other cases is considered to revenue.

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**9. GENERAL PROVIDENT FUND:**

GPF Rules are applicable to those employees of the Institute who were appointed before 1st January, 2004. As per the GPF Rules, a minimum subscription of 6% of emolument is deducted from monthly salary of the incumbents. There is no employer contribution in this scheme, it is treated as non-contributory pension scheme of Government applicable for the incumbents appointed prior to 01.01.2004.

A Fund named GPF having the accumulated balance of aforesaid subscription and interest earned thereon at the applicable rates, determined by the Government from time to time, is maintained by a committee of the Institute who keep appropriate records in this regard. The amount of the said Fund is kept in a scheduled bank.

**10. NPS (EMPLOYER AND EMPLOYEE SHARE):**

ARIES, Nainital is an autonomous institute under Department of Science and Technology and fully funded by the Govt. of India and follow the Govt. norms regarding retirement benefits. New Pension Scheme (NPS) introduced by the Govt. has been adopted by this institute with the approval of competent authority for those employees who was appointed after 01-01-2004. In this scheme, the employee subscription @ 10% of basis + D.A. was deducted and 10% of employer contribution was contributed till 31st March 2019. The Govt. enhance employer contribution from 10% to 14% vide O.M. No. 1/3/2016-PR dated 31st January, 2019 extended for Autonomous bodies vide Department of expenditure, Ministry of Finance, Govt. of India OM No. F. No. 1(3)/EV/2020 dated 26th August, 2021. ARIES has also implemented the revised scheme of enhanced employer contribution w. e. f. 1st April 2019 onwards.

**11. RETIREMENT BENEFITS:**

a. Liability towards gratuity payable on death/retirement of employees is paid as per Govt. norm at the time of retirement.

b. Accumulated leave encashment benefits to the employees are paid as per Govt. norms at the time of retirement.

**12. LEASE:**

Lease rentals are expensed with reference to lease terms.

| | | |
|---|---|---|
| PLACE: ARIES, NAINITAL<br>DATED: September 24 ,2025 | REGISTRAR,<br>ARIES, NAINITAL | DIRECTOR,<br>ARIES, NAINITAL |

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Chartered Accountants
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HALDWANI

ARYABHATTA RESEARCH INSTITUTE OF OBSERVATIONAL SCIENCE (ARIES)

MANORA PEAK, NAINITAL

SCHEDULES FORMING PART OF THE ACCOUNTS FOR THE YEAR ENDED 31ST MARCH 2025

SCHEDULE 25 – CONTINGENT LIABILITIES AND NOTES ON ACCOUNT:

| Sl. No | Particulars | Current Year (INR) | Previous Year (INR) |
|---|---|---|---|
| 1 | **CONTINGENT LIABILITIES:** | | |
| 1.1 | Claims against the Institute not acknowledged as debts | 1,05,65,018.00 | 1,05,65,018.00 |
| 1.2 | In respect of:- | | |
| | Bank guarantees given by/on behalf of the Entity | NIL | NIL |
| | Letters of Credit opened by Bank on behalf of the Entity | NIL | NIL |
| | Bills discounted with Banks | NIL | NIL |
| | | | |
| 1.3 | Disputed demands in respect of: | | |
| | Income Tax | 10,12,72,070.00 | 10,17,36,510.00 |
| | Sales Tax/VAT/GST | NIL | NIL |
| | Municipal Taxes | NIL | NIL |
| | | | |
| 2 | **CAPITAL COMMITMENTS:** | | |
| | Estimated value of contracts remaining to be executed on capital account and not provided for (Net of advances) | NIL | NIL |
| | | | |
| 3 | **LEASE OBLIGATION:** | | |
| | Future obligations for rentals (finance lease arrangement) | NIL | NIL |
| | Arrangement for plant and machinery | NIL | NIL |

**4. CURRENT ASSETS, LOANS AND ADVANCE:**

In the opinion of the Management, the current assets, loans and advances have a value, on realization in the ordinary course of business, equal at least to the aggregate amount shown in the Balance Sheet.

**5. TAXATION:**

In view the fact that the income of the Institute is exempt u/s 12 of the Income Tax Act 1961 and thus there being no taxable income under Income - tax Act 1961 for the financial year 2024-2025, the provision for Income tax is not considered necessary and thus has been made as on 31st March 2025.

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6. **FOREIGN CURRENCY TRANSACTION:**

| Sl. No | Particulars | Current year (INR) | Previous Year (INR) |
|---|---|---|---|
| 6.1 | **Value of Imported Calculated on C.I.F. basis** | | |
| a | Purchase of Finished Goods | NIL | NIL |
| b | Raw Material & Components (Including in transit) | NIL | NIL |
| i | Capital Goods | 8,96,603.00 | NIL |
| ii | Stores, Spares and Consumables | 21,48,729.72 | 36,00,151.35 |
| | | | |
| 6.2 | **Expenditure in Foreign Currency:** | | |
| a | Travel | NIL | NIL |
| b | Remittances and Interest payments | NIL | NIL |
| c | Royalty | NIL | NIL |
| d | Know-How Expenses | NIL | NIL |
| e | Professional Consultancy Fee | NIL | NIL |
| f | Other Expenditure: | | |
| | Commission on Sales | NIL | NIL |
| | Legal and Professional Expenses | NIL | NIL |
| | Miscellaneous Expenses | NIL | NIL |
| 6.3 | Earnings: | NIL | NIL |
| | Value of Exports on FOB basis | NIL | NIL |
| | | | |
| 7. | **PAYMENT TO AUDITORS:** | | |
| a | **As Statutory Auditors** | 45,000.00 | 45,000.00 |
| B | As advisor or in other capacity in respect of: | | |
| | (i) Taxation Matters | NIL | NIL |
| | (ii) Management Services | NIL | NIL |
| | (iii) Certification | NIL | NIL |
| C | Any other matter | NIL | NIL |
| | | | |
| 8 | Contingent Liabilities not provided for | 1,05,65,018.00 | 1,05,65,018.00 |

9. Corresponding figures for the previous year have been regrouped/ rearranged, wherever necessary.
10. Schedules 1 to 25 are annexed to and form an integral part of the Balance Sheet as at 31st March 2025 and the Income and Expenditure Account for the year ended on that date.

PLACE: ARIES, NAINITAL
DATED: September 24,2025

REGISTRAR,
ARIES, NAINITAL

DIRECTOR,
ARIES, NAINITAL

R S KAFALTIYA & ASSOCIATES
Chartered Accountants
FRN:024191C
*HALDWANI*