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KHAGOL

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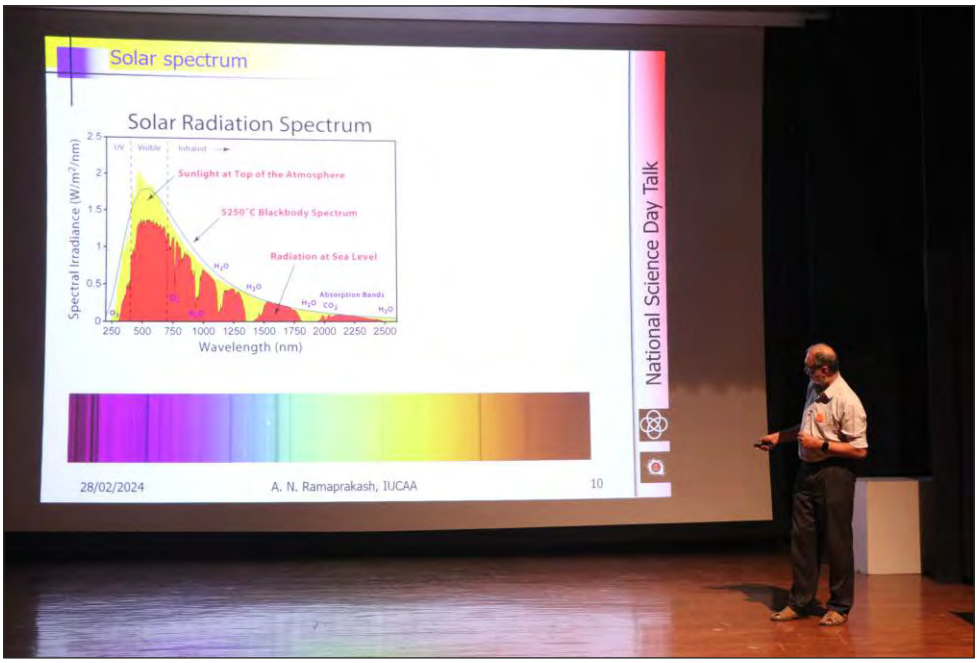
National Science Day 2024

The National Science Day was celebrated with an Open Day on 28th February 2024 at IUCAA and other events throughout February. Like every year, IUCAA responded to people's enthusiasm to associate better with Science and Scientists. The celebrations attracted numerous students around Pune and other parts of Maharashtra, including teachers, parents, and the public.

The whole campus of IUCAA was full of informative and interactive content. The main attractions of the open day were the models of Aditya L1, LIGO-India, TMT, SKA, SALT, Chandrayaan 3 and ASTROSAT. Several spectacular posters by research scholars of IUCAA were displayed. Visitors became aware of the ongoing research at IUCAA and new developments in the subject. There were also demonstrations about Radio Astronomy, Gravitational Waves, Black Holes and Laser Interferometers. Several specially made videos, especially one themed on the Facilities of IUCAA, were very popular. Apart from these, the Foucault pendulum, the statues of great scientists on the campus, short, interactive sessions on Aditya L1, a Live Solar telescope, and the Sun & Solar Astronomy exhibit pulled many people. Shortlisted models made by school students on the theme, 'Optical Illusions', were also exhibited on National Science Day for visitors.

Moupiya Maji, Jitendra Joshi, Swarnim Shirke, Anupreeta More, Sourabh Magare, Disha Sawant, Atharva Pathak, and A. N.

Ramaprakash delivered several talks that kept the audience rooted in the Chandrasekhar Auditorium during the morning session. There was also an interesting session by the 'Astro Mythbusters'. In the afternoon, there was a live public interaction with Jayant Narlikar, R. Srianand, and Surhud More, coordinated by Prasad Adekar. Most of the wonderful questions regarding our universe came from youngsters, and the audience enjoyed hearing the experts answer them. The usual public sky-watching session was also organised, but on the evening of March 15. Around 2,500 people attended the same.



As per tradition, there were also events for school students before the open day. IUCAA Public Outreach personnel conducted a science quiz, essay writing, and drawing competitions for the rural students of the Ambegaon Taluka on February 17, 2024. Prajakta Mane, Rutuja Pilgar, Jitendra Joshi, Ravi Kesarwani and the Scipop Team (all from IUCAA) enthusiastically encouraged students from 15 rural schools, who competed at the venue generously provided by the Government Polytechnic, Awasari.

On February 24, 2024, about 180 students from 36 schools in Pune City responded to IUCAA's invitation and participated in another set of inter-school competitions. Students from classes VIII to X participated in the drawing, essay, model making and science quiz competitions. These coordinators were Vaidehi Paliya, Rajeshwari Dutta, Anupreeta More, Manasadevi T. and Shivaraj Kandaswami. During the first round of Quiz, Moupia Maji gave a fascinating talk to the teachers, who accompanied the students. After the finals of the quiz competition, all winning students received prizes from the IUCAA Director, including the students from the rural schools who were specially invited to IUCAA for a visit that day. All the students were pleased to have a chance to interact with the IUCAA scientists during these National Science Day celebrations.

Winners of the National Science Day Competitions

Rural Schools:

A) Quiz Competition

First Prize:

Harshwardhan Lande, Shital Chobe, Neha Parate (Mangalmurti Vidydham, Ranjangaon)

Second Prize:

Kench, Rudraksha Medage, Tanishka Padwal (New English School, Landewadi)Vishwajit

Third Prize:

Swaraj Gawade Shreyas Gawade, Sairaj Gawade (Hirakani Vidyalay, Gawadewadi)

B) Essay Competition:

First Prize:

Shravani Rakshe (Mahatma Gandhi Vidyalaya, Manchar)

Second Prize:

Anamika Kale (New English Medium School, Ghodegaon)

Third Prize: Sneha Dabhade (D.G. Walse Patil New English School, Pargaon)

Honourable Mention: Akshata Kalhatkar (New English School, Landewadi)

C) Drawing Competition:

First Prize:

Yakshali Joshi (New English School, Landewadi)

Second Prize:

Atharv Salve (Hirakani Vidyalay, Gawadewadi)

Third Prize:

Vadika Tawhare (Pandit Jawaharlal Nehru Vidyalay, Nirgudsar)

&

Kartik Kale (Janata Vidyamandir, Godegaon)

D) Model-Making Competition

First Prize:

Veer Bangar, Aarya Temkar (New English School, Landewadi)

Second Prize:

Saniya Gawari, Samiksha Dongare (Hirakani Vidyalay, Gawadewadi)

Third Prize:

Sai Waman, Jay Patel (New English Medium School, Ghodegaon)

Pune City Schools

A) Quiz Competition

First Prize:

Ishan Vyas, Ruchira Jachak (Pes Modern High School, Pune)

Second Prize:

Chaitanya Harde, Ayush Danke (Dsk School, Dhayari)

Third Prize:

Manas Gupta, Raunak Sharma (Delhi Public School, Pune)

B) Essay Competition:

First Prize:

Kasturi Kulkarni (M S S High School)

Second Prize:

Pranav Deshmukh (Des Secondary School)

Third Prize:

Siddhant Pai (Loyola High School)

Honourable Mention: Chaitali Temkar (Vidya Pratishthan's Vinodkumar Gujar Bal Vikas Mandir)

Tanishka Rasal (Muktangan English School And Jr College)

C) Drawing Competition:

First Prize:

Sneha Pawar (Jnana Prabodhini, Nigdi)

Second Prize:

Radhika Dagade (Mahilashram High School, Pune)

Third Prize:

Sejal Shinde (Aranyeshwar English Medium School)

&

Riya Vanjari (Vidyanchal High School)

Honourable Mention: Arjun Sheth (Symbiosis Secondary School)

D) Model-Making Competition

First Prize:

Netra Wagh, Arya Bhosale (Air Force School, Chandannagar)

Second Prize: Amey Nair, Krishna Chaudhari (Dsk School)

Third Prize:

Avadhoot Modak, Aaryan Joshi (Des Secondary School)

Best School Performance: New English School, Landewadi

Science toys demonstration, Astronomy workshops, and Skywatch events:

Science Toys and Skywatching session at Junnar Taluka Science Exhibition (2 January)

Venue: Samarth Engineering College, Belhe. Participants: 300.

The skywatching event at Andur, Tuljapur. (4 January)

About 200 school students, their parents and teachers got a lot of information during this event at Gramin Vidnyan Kendra, Andur.

Science Club Talk at S P College. (4 January)

A talk on Basic Astronomy and Careers.

Avasara Academy, Lavale Workshop - (12 January)

Science Toys Demonstration session and Skywatching for students and teachers. About 120 students attended the session.

Skywatching Event and Basic Astronomy Session - (17 January)

Venue: SBES College, Chatrapati Sambhaji Nagar.

About 250 students and the public attended the event

Skywatching Event at Indapur - (23 January)

The Panchayat Samiti office in Indapur arranged the event. About 1600 students and 60 teachers attended the event.

Telescope Making Workshop at GLA University, Mathura: (1-2 February)

The event was organised at the Centre for Cosmology, Astrophysics and Space Science (CCASS) in GLAU, also an I-CARD. The workshop's target audience was school students and volunteers from the GLA Astronomy Club, who will carry out regular public outreach with the two telescopes made.

OAE-India Teachers Training Workshop (16-17 February)

The OAE-India Node organised the training at IUCAA; 51 teachers (local and from other states) participated in this training.

Telescope Making Workshop at MVPS, Nashik (27-28 March)

IUCAA and MVPS, Nashik, jointly arranged the workshop, and 25 teachers participated in this training.

(The above sessions had various members of the IUCAA Scipop Team as organisers or resource persons.)

Studying Galaxies using the Hydrogen 21 cm spectral line

What are galaxies made up of?

Galaxies are the building blocks of the Universe. Among the primary open questions of current astronomical research are: 'How are galaxies formed?' and 'How do galaxies evolve with cosmic time?'. To answer these questions, it is imperative to understand the different components of galaxies. It is well known that galaxies are made up of stars – our Milky Way is estimated to contain more than 100 billion stars. However, what may not be well appreciated is that stars make up only a tiny fraction of the total volume in a galaxy. The matter and energy present between stars in a galaxy is called the 'Interstellar Medium' or ISM. For example, the ISM constitutes well over 99.99% of the Milky Way's volume. The ISM mainly consists of low density gas, with the average number density being around one hydrogen atom per cubic centimetre. Most of this gas, about 70% by mass and about 90% by number of atoms, is hydrogen – the most abundant element in the Universe.

Why is hydrogen gas important for galaxies?

The hydrogen in the ISM is present either in its atomic, ionised or molecular form. Out of these, atomic hydrogen, denoted as HI, constitutes about 60% of the total hydrogen gas by mass. Galaxies use gas as a fuel for their growth and sustenance. They acquire ionised hydrogen gas from their surroundings or via interactions with other galaxies. Once accreted onto galaxies, the ionised hydrogen gas converts to HI gas, which eventually forms molecular hydrogen gas with the help of dust grains in the ISM. The molecular gas is the reservoir from which stars are formed in galaxies. The HI gas thus acts as a crucial intermediary phase in the lifecycle of a galaxy. It has a direct impact on the observable properties of galaxies such as the total mass of stars, the rate at which stars are forming, and chemical abundance of the galaxies. While at one hand the HI gas modulates the star formation activity in galaxies, it also gets affected by the radiative, chemical and mechanical feedback associated with star formation. Therefore, in order to understand the physical processes that drive the cosmic evolution of star formation activity in galaxies, it is vital to trace the evolution of the HI gas associated with galaxies. Moreover, the HI gas is typically more extended than the stellar component of galaxies, and is therefore highly vulnerable to distortions caused by interactions with other galaxies and with the environment. Hence, the hierarchical structure formation process of galaxies including mergers and accretion leave discernible imprints on the HI gas.

How do we study the atomic hydrogen gas in galaxies?

The Dutch astronomer, Hendrik van de Hulst, first predicted in 1944 that the hydrogen atom could produce a spectral line at a frequency of 1420 MHz or equivalently at a wavelength of 21 cm. This line occurs due to the electron proton spin-flip transition between the two hyperfine levels in the ground state of the hydrogen atom. In other words, a hydrogen atom with spin of the electron aligned parallel with that of the proton in the hyperfine excited state, undergoes a flip of the electron spin such that it is aligned antiparallel with that of the proton in the ground state, resulting in the emission of a photon with wavelength of 21 cm. Despite being a highly forbidden transition with a very low probability of occurrence, the HI 21 cm line is observable from galaxies thanks to the large amount of hydrogen atoms present in the Universe. Occurring in radio frequencies, this radiation from the hydrogen atom penetrates through dust clouds, and provides us a more complete view of the ISM than that by visible light. The HI 21 cm line from the Milky Way was first detected in 1951 by three independent research groups. Since then, it has become the most important and well studied spectral line in radio astronomy.

What does HI 21 cm emission studies tell us about galaxies?

The HI 21 cm emission line has proved to be a powerful tool for studying the distribution, structure, kinematics, and physical conditions of the atomic gas in the Milky Way as well as other galaxies. In the nearby Universe, blind HI 21 cm emission line surveys using single dish radio telescopes, such as Arecibo and Parkes, have provided reliable measurements of the cosmological HI mass density. On the other hand, spatially resolved HI imaging using radio interferometric arrays, such as the Very Large Array (VLA) and the Giant Metrewave Radio Telescope (GMRT), have characterised the structure and dynamics of galaxies. These observations have facilitated understanding of the relation of atomic gas with the star formation activity and with the environment of galaxies. Additionally, HI 21 cm emission maps of galaxies have been used to derive rotation curves that give the velocity of matter as a function of distance from the centre of galaxies. The rotation curves thus derived turned out to be remaining flat at large distances from galaxy centres, indicating that there is matter in galaxies that is not visible, and thus providing a very important evidence for the existence of dark matter. However, the flux of the HI 21 cm emission signal is inversely proportional to the square of the distance to the unresolved emitting gas. Hence, sensitivities of most present day radio telescopes make it difficult to directly map HI emission from galaxies far away from us.

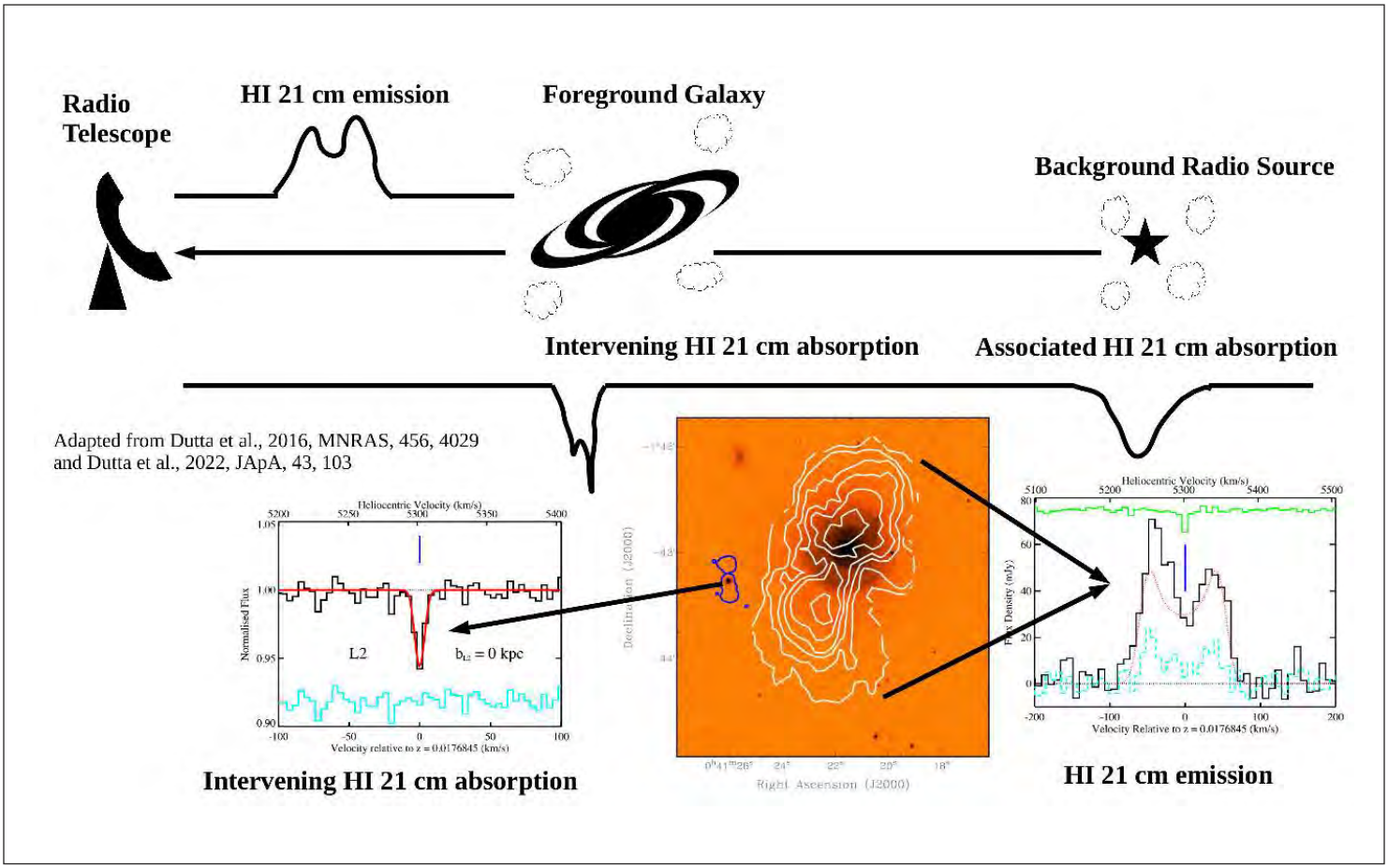
What does HI 21 cm absorption studies tell us about galaxies?

Unlike HI 21 cm emission, the detectability of HI 21 cm absorption is not limited by distance of the absorbing gas, rather it depends only on the strength of the background radio source and the HI 21 cm absorption cross-section projected on the sky by the galaxies. Therefore, HI 21 cm absorption line studies can complement the emission line studies to trace the evolution of the atomic gas component in galaxies. HI 21 cm absorption has been used to constrain the thermal state of the atomic gas using the thermal width of the lines as well as the optical depth, which is inversely proportional to the excitation or

spin temperature of the transition. Further, HI 21 cm absorption has been used to investigate the filling factor of cold gas clouds in the ISM, the small-scale structures of the atomic gas using Very Long Baseline Interferometry, the magnetic field via Zeeman splitting, and variations in the fundamental constants of physics like the electromagnetic fine structure constant, the proton-to-electron mass ratio, and the proton g-factor. Depending on which type of galaxy it is tracing, the HI 21 cm absorption line is classified as 'intervening' if it arises from a galaxy in between the background radio source and the observer, or as 'associated' if it arises from the galaxy of the background radio source itself. Associated HI 21 cm absorption has been used to study the effect of feeding and feedback processes such as gas accretion and outflows in radio-loud Active Galactic Nuclei (AGN).

What are the future prospects of HI 21 cm studies of galaxies?

The unprecedented sensitivity, sky coverage and spatial resolution of the Square Kilometre Array (SKA) will allow us to address a wide variety of open questions in the field of galaxy evolution using the HI 21 cm line. In preparation for SKA, a large number of surveys with SKA pathfinders and pre-cursors, e.g., uGMRT in India, ASKAP in Australia, and MeerKAT in South Africa, are being planned or on the way. Due to the intrinsic faintness of the HI 21 cm emission line, HI mapping of galaxies till date has been feasible only for nearby galaxies, up to redshift, z~0.2. Large HI 21 cm emission line surveys with the above telescopes (e.g., WALLABY, MIGHTEE-HI, MHONGOOSE, DINGO, LADUMA, etc.) are extending the scope of HI 21-cm emission studies of galaxies to higher redshifts (z~1) and larger statistical samples, by improving the observational capabilities in radio astronomy such as sensitivity, survey speed, and spatial resolution. When it comes to HI 21 cm absorption, the relatively small number of such absorbers detected to date (~200) hinders our ability to utilise these absorbers to trace the evolution of cold atomic gas and its interplay with galaxies across cosmic time. The main technical limitations affecting HI 21 cm absorption searches so far have been small bandwidths and restricted frequency ranges due to the presence of strong radio-frequency interference (RFI). The instantaneous large bandwidths, broad frequency coverage in low-RFI environments and high survey speed of the new radio telescopes are enabling large, blind and wide-area surveys of HI 21-cm absorption, e.g., MALS with MeerKAT, FLASH with ASKAP, SHARP with APERTIF. These surveys will not just expand the sample sizes of HI 21-cm absorbers by over an order of magnitude, being blind surveys they will enable us to trace the cosmic evolution of cold atomic gas content in galaxies in a systematic and unbiased way using homogeneous samples.



Professor Rajeshwari Dutta is an observational astronomer working in the field of galaxies. She is currently an Assistant Professor at the Inter-University Centre for Astronomy and Astrophysics (IUCAA) in Pune, India. After completing her PhD from IUCAA, she held a Humboldt Research Fellowship at European Southern Observatory (ESO) in Garching, Germany, a Postdoctoral Research Associateship at Durham University in the UK, and a Postdoctoral Research Fellowship at the University of Milano-Bicocca in Italy. Her primary research interests are in galaxy formation and evolution, particularly in the connection between gas and galaxies. Her work utilises multi-wavelength (UV to radio) spectroscopic observations to understand the role played by multiphase gas in galaxy evolution.

AGN Exploration Utilizing Data from 1-2m Telescopes: A Study of Weak Emission Line QSOs

Active Galactic Nuclei (AGN) are among the most fascinating and enigmatic phenomena in astrophysics. These cosmic powerhouses, harboring supermassive black holes at their cores, emit vast amounts of energy across the entire electromagnetic spectrum. Investigating the AGN environment and central engine provides crucial insights into fundamental astrophysical processes and the evolution of galaxies. While large observatories often dominate AGN research, 1-2m optical telescopes play a significant and complementary role. For instance due to the relatively smaller size of 1-2m class telescopes, it has become economically viable to carry out more frequent observations, enabling astronomers to capture transient events and study their evolution over time. This allows moderate aperture telescopes contribute in many ways such as carrying out (i) Large surveys (ii) Principle Investigator driven science programme requiring frequent observations, so as to compete on a level playing field for publicly available time on large telescopes for further research improvements (iii) Time domain science programs, including those that require telescopes spaced longitudinally for long time coverage.

With recent advent of large spectroscopic surveys such as SDSS, a subclass of AGNs is found with Weak (or absent) Emission Lines, known as Weak Emission line quasars, contrary to the expectation as the strong emission line are the hall-mark of AGNs. Such weak or absence of emission are well understood in another subclass of AGN, known as BL-lac, where a relativistic jet is responsible for doppler boosting of their continuum emission leading to relatively weaker/absent emission lines. The jets' existence is evident from the synchrotron emission observed from them in radio waveband, which is found even more than the total emission in optical waveband. On the other hand the WLQ subsample is found to be radio-undetected, and hence the cause of the weakness of their emission line poses an intriguing puzzle. Due to this radio-quietness of WLQs they are also proposed as a potential candidate for the radio-quiet counterpart of BL-lac in AGNs unification scheme. The discovery of even a minuscule set of bona-fide radio-quiet BL-Lac among them would have fundamental implications for the current understanding of AGNs and their classification scheme.

To understand the nature of these newly discovered radio quiet-WLQs (RQWLWQs), a detailed systematic study was accomplished recently by the team of Prof. Hum Chand along with his students and collaborators. As a first step in their program, they have used the fact that optical variability properties can be used as a tool to discriminate among the various subclasses of AGNs. For instance, it has been established that normal quasars (i.e., non-BL-Lac type) almost never vary by more than 3-4% on hour-like time scales and on the other hand stronger optical variability due to relativistic jets is a clear signature of the BL Lacs type of sources. As a result, carrying out intra-night optical variability of a sample of WLQs can be used as an first step to ascertain that weather the variability nature of WLQs are similar to Bl-Lac type (i.e high percentage variation) or like normal quasars (i.e low percentage variation). The monitoring is carried out by using ARIES 1.3m Devasthal Fast Optical Telescope (DFOT) where a sample of about three dozen of RQWLQs is monitored for about 5 dozen sessions with duration 3-4hrs during a period of 3-4 years led by a PhD student Parveen Kumar in the team. Their detailed investigations as reported in a series of publications (in British Journal MNRAS) revealed that the variability duty cyce of the RQWLQs is about 3-5% which appears similar to the normal quasar, in striking contrast to the expectation of higher variability for qualifying them as radio-quite counterpart of Bl-Lac.

Secondly, the same team has also complemented their results based on polarimetric observations, though using a rather smaller set of 6 WLQs, and found percentage polarization always less than 3 percentage level in contrast to much higher polarization seen in BL Lacs objects. This rule out the possibility of WLQs being radio-quiet counterpart of Bl-lac, and leads to the conclusion that perhaps the cause of the weakness of the emission line

in WLQs may be related to a rather evolutionary scenario, where their Broad Emission line Region (BLR, responsible for strong emission line in AGNs) is perhaps not well developed as can happen in the early stage of AGN formation.

To ascertain this possibility, another PhD student of the same team, Ritish Kumar, at Central University of Dharamshala, carried out the Spectral Energy Distribution (SED) of 61 RQWLQs and compared them with that of SED of control samples of normal QSOs using SDSS and WISE data. In their detailed SED decomposition, one main difference they found is that the luminosity from the "dusty torus component" in their fitting, is about 42 percent smaller in WLQs compared to the value found in their control sample of normal Quasars.

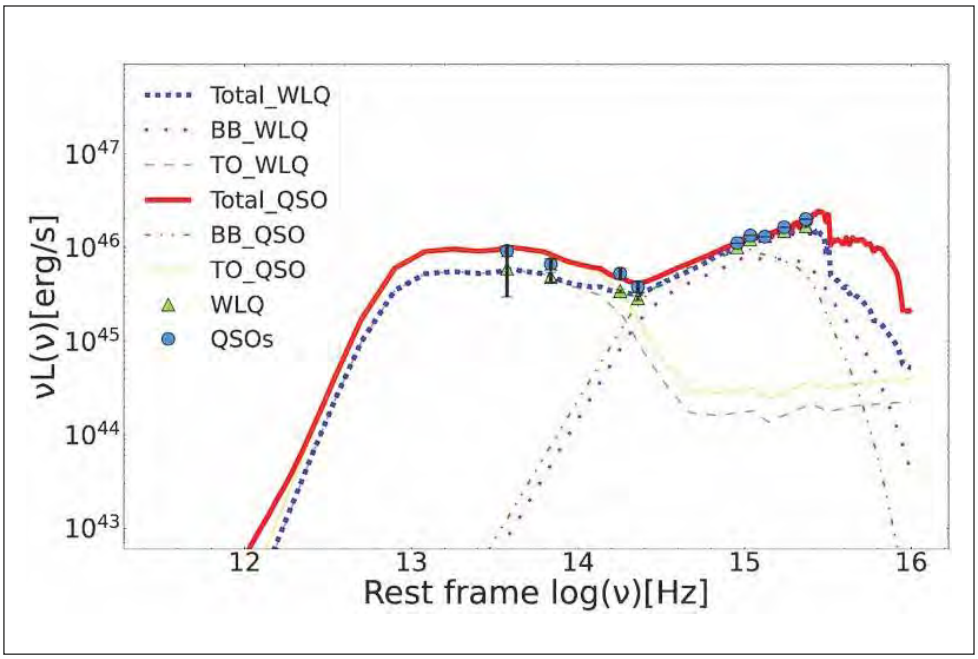


Figure 1: Illustration of the best-fitting SED comparison of different components of emission in one of the WLQs from our sample along with its control sample of normal QSOs matched in redshift and optical luminosity [Kumar, Chand & Joshi 2023, MNRAS 2023, 519, 3656].

As dusty torus and BLR covering factors are expected to be of a similar order in AGN, so their analysis has clearly shown that the BLR in the WLQs is underdeveloped and could be a dominant cause of the weakness of their emission line. These series of experiments, mainly using photometric data from 1-2m class telescopes, among various possible models has given support to the evolution scenario as the cause of weak emission lines in WLQs, and have helped to resolve this puzzle beyond doubt.

Like this team-driven specific programme, more ambitious large survey driven programs, such as the ongoing Zwicky Transient Facility (ZTF) over the last five years, are also found extremely important to address the various cutting edge mysteries in AGNs research. These surveys allow statistical study of even large representative samples of AGN class. For instance, another member of the same team, with lead by Vibhore Negi for his PhD work, uses a large sample of about 455 Bl-Lac and 442 Flat Spectrum Radio Quasar (FSRQ) to carry out their color variability using ZTF 'g' and ' r' band light curve. Until now such studies are carried out on individual sources (rather with biased source selections) and with surveys such as ZTF using 1-2 m telescopes, it has become possible to carry out such detailed investigation for the first time with such a large sample for various AGN classes .

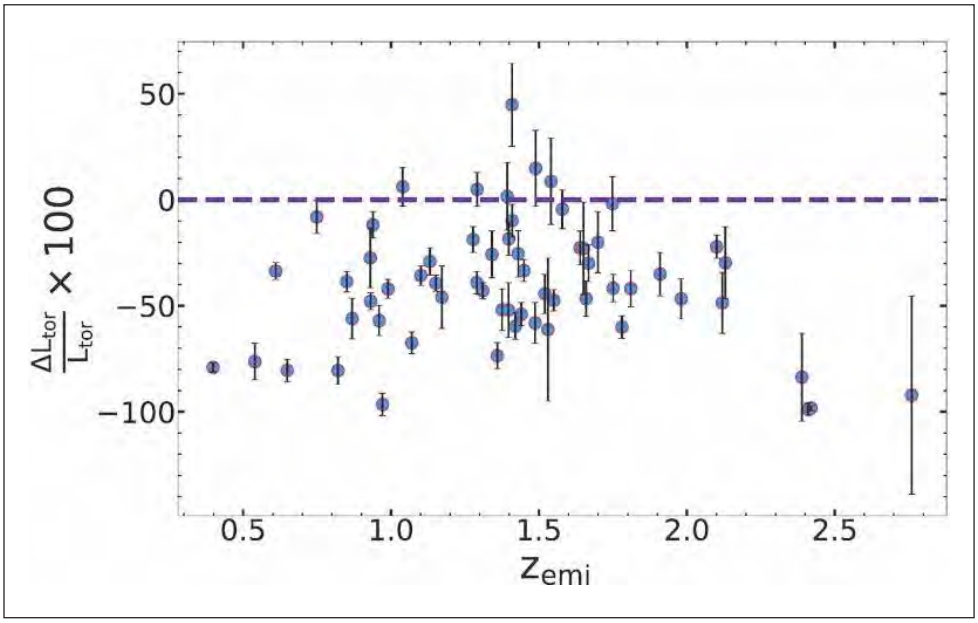


Figure 2: The plot shows emission redshift (zemi), computed for each member of the WLQ with respect to its control sample of normal QSOs. It can be noticed that (i) except for a few outliers, all the WLQs show smaller torus luminosity in comparison to their redshift and r-band magnitude-matched sample of normal QSOs, and (ii) there is no significant trend in the ΔLtor/Ltor as a function of emission redshift [Kumar, Chand & Joshi, MNRAS, 2023 519, 3656]

In conclusion, this article underscores the importance of 1-2m class optical telescopes in advancing AGN research by highlighting an example of a programme recently carried out using 1.3m DFOT. Owing to their relatively smaller running cost such a network of small telescopes in general can enhance the astronomy research and training activities especially at the University sector (having limited access to large aperture telescopes), in conjunction with the various survey

archival data. Despite their relatively modest aperture size, these telescopes offer valuable opportunities for studying various galactic and extrag-galactic phenomena, and complementing observations from larger facilities. By leveraging the capabilities of 1-2m telescopes alongside other observing resources, researchers can continue to unravel the mysteries surrounding our Universe and deepen our understanding of these enigmatic cosmic entities.

Professor Hum Chand is an IUCAA Associate who works on various observational aspects of AGNs and quasars absorption lines. His present research group at the Central University of HP (CUHP) consists of one National Post-Doctoral fellow and five PhD students.

Events at IUCAA

Pune-Mumbai Cosmology Meeting at IUCAA

A two-day meeting, 'Pune-Mumbai Cosmology Meeting,' was held at IUCAA, Pune, on February 23 and 24, 2024, that brought together scientists working in theoretical, numerical and observational aspects of cosmology from the Pune Mumbai region.

The meeting was attended by fifty participants, including students, postdoctoral scholars, and faculty from IUCAA, IISER Pune, TIFR, and IIT Bombay. The students and postdoctoral scholars were given an opportunity to introduce their work to a broader cosmology audience and to help foster collaborations.

The topics included cosmic reionization, 21 cm cosmology, Lyman alpha forest, primordial black holes, and large scale structure, amongst others. The final afternoon of the meeting was devoted to the discussion of new ideas and proposals in several breakout sessions. The summary of the breakout session was summarised to the entire group at the end of the workshop, and future plans were chalked out to continue these collaborative discussions.

The next iteration of the meeting is expected to be held at the TIFR. The meeting was coordinated by Surhud More and Aseem Paranjape.

Teacher Training Workshop, Office of Astronomy for Education (OAE) Center, India

The Office of Astronomy for Education (OAE) Center India organised a two-day Teacher's Training Workshop on 16 and 17 February 2024. The workshop was targeted towards school teachers who teach grades 5 - 10.

The core idea of the workshop was to revisit the various astronomy concepts taught in schools, discuss pedagogical approaches, and explore the basics of astronomy. The sessions were delivered by various resource persons from IUCAA and Homi Bhabha Centre for Science Education (HBCSE - TIFR).

In particular, there were sessions on phases of the moon (conducted by Moupiya Maji, IUCAA), eclipses (Sai Shetye, HBCSE), seasons (Asmita Redij, HBCSE), tides (Pritesh Ranadive, HBCSE), solar system (Prasad Adekar, IUCAA), lifecycle of stars (Surhud More, IUCAA), the scales of the Universe (Moupiya Maji, IUCAA), upcoming space missions (Kshitij Chavan, IUCAA), science toys (Rupesh Labade and Shivani Pethe, IUCAA) and interdisciplinary teaching practices (Asmita Redij, HBCSE). It was a mix of lectures, hands-on activities, and interactive sessions. In addition, a sky-watching session was arranged for the participants in the evening.

A total of 46 teachers attended the workshop; 35 (selected from about 200 applications) were from the Pune region and 11 came from Chennai. We received highly positive feedback from the participants about the workshop. We also carried out a pre- and post-workshop survey with the teachers, and the data analysis shows that the sessions positively impacted the teachers. The workshop was coordinated by Moupiya Maji and Surhud More.

Events Outside IUCAA

Workshop on Gravitation: Theory and Observation

A workshop titled "Gravitation: Theory and Observation" was held at the IUCAA Centre for Astronomy Research and Development (ICARD), Department of Physics, Cooch Behar Panchanan Barma University (CBPBU) on 03 January 2024. The Hon'ble Vice-Chancellor, Prof. Nikhil Chandra Roy, inaugurated the programme. The university registrar, Dr. Abdul Kader Safily, was present at the programme.

Prof. Kanak Saha, IUCAA, Dr Arunava Bhadra, and Dr Tamal Sarkar from the University of North Bengal participated as resource persons in the workshop. The speakers discussed various aspects of current research initiatives in astrophysics and cosmology. The main thrust of the workshop was to provide hands-on training on SciLab in astronomy to interested researchers and students. The workshop was a huge success in terms of the active participation of more than eighty participants (post-graduate students, research scholars and faculty members) from nearby colleges and universities. The workshop was organised by Ranjan Sharma (CBPBU) and Kanak Saha, IUCAA, Pune.

Research in Astronomy: Opportunities and Challenges - RAM IX

The ninth Regional Meeting on 'Research in Astronomy and Challenges' (RAM 2024) was held at the Manipal Centre for Natural Sciences, Manipal Academy of Higher Education (MAHE), Manipal, from January 10-12, 2024, jointly organised and funded by MAHE and IUCAA.

The Regional Astronomy Meeting on 'Research in Astronomy and Challenges is an annual program that aims to provide a platform for researchers from universities and institutes, mainly from Kerala, Karnataka, and Tamil Nadu, to showcase their work and encourage future collaborations.

One hundred twenty-two university and institute researchers participated in the three-day meeting. Among fifty-four abstracts, twenty-nine were selected for oral presentation, and fourteen abstracts were selected for poster presentation. Additionally, there were dedicated discussion sessions on establishing a roadmap for inter-institutional collaborative research work, which is the key to addressing significant science problems. The meeting was organised by Debbijoy Bhattacharya (MAHE) and Ranjeev Misra, IUCAA.

X-ray workshop -- Astrosat and XpoSat

The AstroSat Science Support Cell (ASSC), IUCAA, ISRO and Department of Physics, Providence Women's College, organised a five-day workshop for Research Scholars and motivated M.Sc students from 28 February to 03 March 2024 at the Department of Physics, Providence Women's College, Malaparamba, Kozhikode. The workshop was organised for the benefit of research scholars and postgraduate students in X-ray astronomy.

Apart from lectures describing AstroSat and XpoSat data analysis and Science, the primary component of the workshop was research projects undertaken by a group participants under the guidance of Postdocs and Faculty members. Led by scientists from ISRO and IUCAA, the workshop trained the participants on using astronomical data from the Indian space telescope Astrosat launched by ISRO to bring in new findings in the field of X-ray Astronomy.

Thirty-seven research scholars from various institutes and universities attended the workshop. Five M.Sc students also were part of the program. Resource persons were Prof. Ranjeev Misra, IUCAA; Prof. Shiv Sethi, RRI; Prof. Gulab Dewngan, IUCAA; Prof. Kanak Saha, IUCAA; Dr Mohammed Hassan, ISRO; Dr. Akash Garg, Post Doc, IUCAA, Dr Sahir Shah, IUCAA, Dr Savithri Ezhikode, Post Doctoral Fellow, Christ University, Dr Chayan Mondal, Post Doctoral Fellow, IUCAA, Dr.Swadesh Chand, Post Doc, IUCAA and Mr.Pushpak Pandey, Research Scholar, IUCAA.

The workshop was coordinated by Gireesh V., ISRO, Jeena K, Providence Women's College, and Ranjeev Misra, IUCAA.

Conference on Relativistic Astrophysics and Cosmology

The Conference on Relativistic Astrophysics and Cosmology was held from 29 February to 01 March 2024 at the Department of Physics, Malda College, Malda, West Bengal. The inaugural session was attended by the Honourable Vice-Chancellor of the University of Gaur Banga, Professor Rajat Kishor Dey, Dr Manas Kumar Baidya, Principal of Malda College; Dr. Narayan Chandra Shaw, IQAC Coordinator of Malda College; Professor Bikash Chandra Paul [North Bengal University]; Dr. Surhud S. More [IUCAA, Pune [online]]; Professor Megandhren Govender [Durban University of Technology, South Africa [online]]; Professor Farooq Rahaman [Jadavpur University]; Professor Biplab Raychaudhuri [Visva-Bharati, Santiniketan]; Professor Mehedi Kalam [Aliah University]; and Professor Prabir Kumar Haldar [Cooch Behar Panchanan Barma University]. Mrs. Moumita Das, Head, Department of Physics, Malda College, invited the dignitaries to the dais and felicitated by the students of the Department. A symbolic gesture of nurturing knowledge and growth was portrayed through the watering of a plant by all the guests, symbolising the nurturing of new ideas and collaboration in Astrophysics & Cosmology.

Dr. Manas Kumar Baidya, Principal Malda College, extended a warm welcome through his opening speech, expressing gratitude for the esteemed gathering and highlighting the significance of scientific research in fundamental sciences. Professor Rajat Kishore Dey, Vice Chancellor of the University of Gour Banga, echoed similar sentiments, emphasising the pivotal role of such conferences in fostering innovation and advancing scientific knowledge. Prof. Bikash Chandra Paul addressed the participants and discussed the importance of attending such a conference for students in their early research careers. Dr Ankur Sensharma, Head, Department of Physics, University of Gour Banga, expressed his heartfelt gratitude to the organisers for the initiative taken by the Department of Physics, Malda College, Malda. Concluding the inauguration session, the Convenor of the conference, Dr Shyam Das,

expressed heartfelt gratitude to Prof. Ranjeev Misra, IUCAA, for sponsoring this conference and also thanked all the distinguished guests, invited speakers, paper presenters, participants, and everyone involved in organising the conference. Their collective efforts were instrumental in making the conference a resounding success, setting the stage for insightful discussions and fruitful collaborations in Relativistic Astrophysics & Cosmology.

Prof. Bikash Chandra Paul, Department of Physics, and Coordinator, ICARD, University of North Bengal, delivered the conference's keynote address. His address titled "Cosmology: Status report theory and observation" was delivered with eloquence and scholarly insight, captivating the audience and sparking heightened interest in Relativistic Astrophysics and Cosmology. He also emphasised the importance of conferences like this in providing young minds early exposure to the field.

Prof. Farook Rahaman and Dr. Surhud More chaired the first technical session of the conference. Dr More delivered a brilliant talk in the online session on "Subaru Hyper Suprime Cam Survey Report: Cosmological constraints from weak lensing observations," focusing on detecting dark matter using various techniques. The talk was followed by another interesting online talk by Prof. Megandhren Govender from Durban University of Technology, South Africa, on "A brief history of radiating stars". Both the talks generated enthusiasm among the audience, evident from the wide range of questions and queries. Prof. F. Rahaman thanked the speakers for their talks, and then the session was followed by a lunch break. Professor B. C. Paul chaired the post-lunch technical session, where four papers were presented in an hour. After the tea break, the final technical session of the day was chaired by Prof. Prabir Kr Haldar. In this session, four papers were presented by scholars from different parts of the country.

A brainstorming session for an hour was scheduled after the technical session -III as an open forum to discuss the queries and questions from the participants with the eminent speakers. Every participant of the conference enjoyed this session. The poster session was held after the last technical session of the day, where scholars presented eight posters on a wide range of topics.

In the evening, a cultural program was held at the Durga Kinkar Sadan of Malda College, anchored by Dr. Uttam Kr Sarka, Department of Physics, to refresh the participants. Solo and group songs, as well as dances, were performed by various artists. A typical folk song and dance performance, "Gombhira", as a cultural signature of the local area of Malda town, captivated the audience with its unique, humorous, yet subtle and relevant socio-cultural state of affairs of the present society.

The second day of the conference was conducted by Dr Siddarth Rai, Assistant Professor and Sri Bishnu Bhowmik, SACT of the Department of Physics. The program began with the invited talks of eminent speakers and the session chaired by Prof. Biplab Raychaudhuri. Professor Farook Rahaman gave an intriguing talk on "Black Hole: A General Perspective", arousing deep curiosity among students and the audience. The second talk, "Gravitational Singularities and their Possible Resolutions", was given by Prof. Andrew DeBenedecits from Simon Fraser University, Canada (online). Prof. Farook Rahaman chaired the post-tea break invited talk session. In this session, Prof. Biplab Ray Chowdhuri gave an engaging talk on "Dim light falls on this part of relativity". After that, Prof. Mehedi Kalam presented his talk on "Gravitational Lensing: Application to General Relativity," followed by a talk on "Gravitational decoupling approach in GR and modified gravity Theories" given by Prof. S. K. Maurya from the University of Nizwa, Oman (online). The final technical session of the conference was chaired by Professor Mehedi Kalam, where scholars presented seven papers on a wide range of topics.

At the end of the conference, the valedictory session was conducted by Dr Uttam Kr Sarkar. This session was marked by the presence of the Principal of Malda College and the invited speakers at the conference. The participants expressed their heartfelt gratitude and appreciation for the meeting organisers. Dr. Shyam Das, Convenor of the conference, expressed sincere gratitude to the Principal, Malda College, invited speakers, participants, students, and others for their support at various stages from the commencement to the conclusion of the Conference. The conference was organised by Shyam Das (Malda College) and Ranjeev Misra (IUCAA).

Workshop on SUIT Science and Data Analysis

The Department of Physics, Tezpur University, in collaboration with IUCAA, Pune, conducted a two-day workshop entitled ADITYA-L1: Workshop on SUIT Science and Data Analysis from 6-7 March 2024. There were fifty-three participants; eighteen were from different parts of Assam, West Bengal, Arunachal Pradesh, Meghalaya, Orissa, and Uttar Pradesh, and thirty-five were from Tezpur University. The convenor of the workshop was Professor Gazi Ameen Ahmed (Tezpur University), and the resource persons were Professor A.N.Ramaprakash (IUCAA), Professor Durgesh Tripathi (IUCAA), Mr Janmejoy Sarkar (IUCAA, TU), Mr Soumya Roy (IUCAA), Dr Sreejith Padinhatteeri (MAHE, Manipal), Dr Aishawnnya Sharma (Bahona College, Jorhat, Assam), Professor Pralay Kumar Karmakar (Tezpur University), Dr. Rupjyoti Gogoi (Tezpur University) and Dr. Moonmoon Devi (Tezpur University). Over and above the talks by the

resource persons, the participants were given hands-on training on the Solar Ultraviolet Imaging Telescope (SUIT) data analysis at the computer centre at Tezpur University. There was also a skywatching programme on the second day of the workshop at the Tezpur University Observatory, which Dr. Kishor Kumar Baruah (Tezpur University) facilitated.

The main aim of this workshop was to foster an interest in the ongoing research activities in Solar Physics in the country, mainly the research planned using SUIT mounted on the ADITYA-L1. Professor Durgesh Tripathi spoke on the genesis of the Aditya mission, basics of Solar Physics, Solar atmosphere and features, Lagrange Points, the significance of L1, motivation for proposing SUIT, science goals of SUIT and the future scope of solar physics with SUIT data. Professor A.N.Ramaprakash spoke on meeting science goals with instrument design, the spirit of instrumentation, Challenges in SUIT design with emphasis on rigidity, lightweight, reliability, challenges in SUIT realisation, contamination control, handling, UV hazards, Ozone build-up hazards, SUIT subsystems, Flight to L1, Challenges and solutions of contamination due to thruster ejecta and depressurisation during lift-off. Dr Sreejith Padinhatteeri spoke on On-board intelligence of SUIT, Imaging cadence and SUIT features, what makes Aditya an 'Observatory Class' mission, coordinated science of SUIT with other Aditya payloads, data access and proposal submission. Mr. Janmejoy Sarkar spoke about the realisation of SUIT, optical alignment, filter characterisation, contamination control, the need for qualification tests, vibration and TVAC, satellite integration, satellite orientation, image reduction, and flat fielding. Mr.Soumya Roy spoke on identifying different solar features, identifying flares, basics of solar flares, Solar flare observation, how SUIT complements existing flare observations, co-observation with SUIT and other instruments and combined science scope. The rest of the resource persons also gave similar talks related to instrumentation and solar physics. During the inaugural session of the workshop, Tezpur University Vice Chancellor, Prof. Shambhu Nath Singh, lauded the Department of Physics, Tezpur University, for taking the initiative and holding a workshop related to the ADITYA L1 mission in the north-east for the first time. Several students engaged in immersive discussions with the resource persons. Many students came forward and mentioned that the hands-on session had been instrumental in giving them working knowledge to carry out preliminary image analysis, which would be very useful for their PhD and projects. Overall, the participants enjoyed every moment of the workshop, which was held on the beautiful campus of Tezpur University, and finally, everybody agreed that the workshop was a grand success. The workshop was organised by Gazi Ameen Ahmed, Tezpur University, in coordination with Janmejoy Sarkar, IUCAA & Tezpur University and Durgesh Tripathi, IUCAA.

Workshop on Formation and Evolution of Galaxies

A Workshop on Formation and Evolution of Galaxies was held from 18 to 20 March 2024 at the Central University of Haryana, Mahendragarh. Sixty participants including masters and research scholars from different universities participated in the workshop.

The inaugural session was presided over by Prof. Tankeshwar Kumar, Vice Chancellor, Central University of Haryana. In the inaugural address the Vice Chancellor encouraged the students to participate in exploring the new horizons within the realms of Astronomy and Astrophysics. Prof. T.R. Seshadri, Delhi University delivered the inaugural lecture of the workshop on 'Physics of Early Universe and Seeds for Galaxy Formation'.

Prof. Jasjeet S. Bagla, IISER Mohali delivered the afternoon lecture on N-Body simulation. The lecture was follwed by a hands on session on running N-body simulations for dark matter particles. On the second day there were talks and hands on session on the impact of galaxy evolution on statistics of large-scale structure. Prof. Aseem Paranjape, IUCAA was the invited speaker and coordinated the hands on session on halo formation models in N-Body simulations. The students enthusiastically participated in the discussions and the computer related activities related to formation and evolution of galaxies. On the third day, Prof. Dipanjan Mukherjee, IUCAA delivered a lecture on AGN feedback processes in galaxy formation and evolution and Prof. Smriti Mahajan, IISER Mohali delivered a lecture on Dwarf and giant galaxies. In the afternoon the students participated in the hands on session on different properties of galaxies.

The concluding session of the workshop was graced by several dignitaries of the university where the local coordinator proposed a vote of thanks to IUCAA for the financial support for the workshop and to the local university administration for the logistical support. The workshop was covered by different local newspapers in hindi as well as English.

The workshop was coordinated by Jaswant Yadav, CUH, and Aseem Paranjape, IUCAA.

Workshop on Advancement in AGN, Galaxy, Cluster and IGM Research

A workshop on Advancements in AGN, Galaxy Cluster and IGM Research was held at the Dharamshala Campus of the Central University of Himachal Pradesh Dharamshala, H.P. from 29 to 31 March 2024. The primary objective of this conference was to bring together astronomers, astrophysicists, and cosmologists, including both early-career researchers and seasoned experts interested in diverse aspects of galaxy, cluster, and intergalactic medium research. The program was structured to encourage collaboration and exchange of ideas for long-term fruitful collaboration between researchers in Institutes and Universities. All the participants presented their work and outlined future plans for impactful scientific contributions from the country as a team.

The first day of the workshop focused on reviewing the science of the circumgalactic medium (CGM) and IGM, including the latest updates from simulations. The second day concentrated on the science of diffuse matter in the Universe. The third day covered active galactic nuclei (AGN) and their environments based on multi-wavelength data and a conference summary.

The conference hosted around twenty-one participants, including 11 students from the university sector. IUCAA provided financial support for this workshop. The workshop was coordinated by Hum Chand (CUHP) and Sowgat Muzahid, IUCAA.

Welcome to...

Addition to IUCAA Core Faculty

Dr Anupam Bhardwaj works on precision stellar astrophysics and the cosmic distance scale using multi-wavelength photometric and spectroscopic observations of classical pulsating variable stars. He completed his doctoral research at the University of Delhi, India, between 2012 and 2018, including a one-year studentship at the European Southern Observatory, Garching, Germany. After that, Dr Bhardwaj moved to the Kavli Institute for Astronomy and Astrophysics and the Peking University in China for a post-doctoral fellowship from 2018 to 2020. Dr Bharadwaj held an East Asian Core Observatories Association Fellowship in 2021 at the Korea Astronomy and Space Science Institute in South Korea. He was a Marie-Curie Fellow of the European Commission between 2021 and 2024 at the National Institute for Astrophysics, Capodimonte Observatory in Naples, Italy, before joining IUCAA as an Assistant Professor in March 2024. He was also one of the recipients of the prestigious Gruber Foundation fellowship 2020 award by the International Astronomical Union.

Subhashree Swain, Vibhore Negi and **Sneha Vaibhav Pandit** (CEFIPRA Project) who have joined IUCAA as *post-doctoral fellows*.

Farewell to...

Abhishek Mohapatra and **Sujaya Das Gupta,** *Post-Doctoral Fellows,* who left IUCAA at the end of their tenure or to take up a new assignment.

Kanchan Soni, *Senior Research Fellow,* who left IUCAA at the end of her tenure

Colloquium

07.03.2024 Arif Babul *on* ***The Formation and Evolution of Massive Galaxies in the Cosmos and their Circumgalactic Environment.***

Seminars

02.01.202	Sumanta Chakraborty *on* ***The conundrum of tidal Love number.***
04.01.2024	Vinay Kashyap *on* **25 Years of Science with Chandra.**
09.01.2024	Aru Beri *on* ***Probing regions of strong gravity using fast-timing, multi-wavelength diagnostics and prospects with X-ray polarization.***
16.01.2024	Swagat Saurav Mishra *on* ***Primordial black holes and stochastic inflation beyond slow roll: Noise matrix elements.***
25.01.2024	Dusmanta Patra *on* ***Spectral index variation across X-shaped radio galaxies.***
06.02.2024	Siddartha Gupta *on* ***Nonthermal Particles in Collisionless Shocks: Investigating Injection and Acceleration Mechanisms through Kinetic Plasma Simulations.***
08.02.2024	Suman Bala *on* ***Gamma-Say Bursts (GSBs) as electromagnetic (EM) counterparts of Gravitational Wave (GW) sources with Fermi GBM.***
20.02.2024	Sayan Saha *on* ***Novel Bayesian Inferences from the Cosmic Microwave Background.***
22.02.2024	Satadru Bag *on* ***Harnessing the Unresolved Lenses: Detecting Strong Lenses and Measuring Time-Delays from Unresolved Light Curves.***
05.03.2024	Rajesh Mondal *on* ***The 21-cm cosmology.***
12.03.2024	Saikruba Krishnan *on* ***Multi-wavelength study of an X-ray flaring event and a variable soft X-ray excess in Seyfert galaxy detected with eROSITA.***
19.03.2024	Chandreyee Maitra *on* ***Exploring the hot and energetic universe: from ultra-luminous X-ray pulsars to nuclear burning white dwarfs.***
21.03.2024	Atreyee Sinha *on* ***Development of the CTA Science Tools, and some interesting results with H.E.S.S.***
28.03.2024	Swagat Mishra *on* ***Towards the origin of matter in the universe: Inflation fragmentation, Oscillon formation and decay.***

Office of Astronomy for Education (OAE) Center, India

Astronomy Centre for Educators

1. **Objective: Professionalize astronomy education**

   The OAE Center India funded the IAU teacher training program selected as part of the OAE TTP 2023 on Feb 20-22, 2024, organised by RAEC Niruj Mohan together with Jayant Ganguly from the Regional Science Centre in Calicut in the southern part of India. Thirty teachers attended the workshop. The primary objective of the training program was to familiarise participating teachers with recent advancements in astronomy, presenting information in a systematic and engaging manner. To achieve this, the program utilised low-cost education kits, models, activity sheets, image and data analysis, and sky observation sessions facilitated by astronomy educators and astronomers. Additionally, the program aimed to evaluate the effectiveness of introducing various astronomical events and phenomena to students to ensure a comprehensive understanding and retention of the subject matter.

   The OAE Center India also organised a teacher training program at IUCAA from 16 to 17 February 2024, targeted towards teachers from Grades 5- 10. It covered various topics taught in the school curriculum, emphasising the basics, addressing misconceptions, and using hands-on activities. Forty-six teachers attended the program.

2. **Objective: Provide access to good resources**

   Resource Translations

   OAE Center India has prepared a translated version of the astronomy literacy book called Big Ideas in Astronomy. The OAE Centre India has published and procured the following books during this quarter:

   - Big Ideas in Astronomy (Hindi and English versions)
   - Jantar Mantar observatories (Marathi, Hindi and English versions)
   - Anandi Khagol Goshti

   The procured books will be distributed to school libraries within the Pune and rural regions, together with supporting activities for the upcoming quarter. The OAE Center India personnel at HBCSE continue to produce and release a series of educational videos in astronomy to make astronomy concepts more accessible since January 2024.

3. **Objective: Promote astronomy in curricula**

   The OAE Center India continued its work in education research with the ongoing baseline survey in Astronomy, where the status of astronomy education amongst school students and teachers is being analysed.`

4. **Objective: OAE Networking**

   The OAE Center India team helped with the National Science Day activities and organised the public outreach and education session of the Astronomical Society of India held in IISC Bengaluru. The latter was helpful in bringing together people from different parts of the country working on education and outreach, sharing their experiences and collaborating with each other. The activities of the centre were also publicised during the plenary ASI session to reach professional astronomers.

Astronomy Centre for Educators

Malaviya Mission Teacher Training Centre

Pedagogic Workshop on Astronomy, Astrophysics and Cosmology: A Faculty Development Programme at Gauhati University

Group photograph of the participants in the workshop on Astronomy, Astrophysics and Cosmology held at Gauhati University.

A Pedagogic Workshop on Astronomy, Astrophysics and Cosmology was organised by ICARD, Gauhati University (GU) in collaboration with the Malaviya Mission Teacher Training Centre of the Astronomy Centre for Educators, IUCAA during 4th to 10th January, 2024. The major goals of the workshop were to (a) enrich college and university teachers with new developments in astronomy, astrophysics and cosmology, (b) familiarise them with methods of teaching various topics on astronomy and astrophysics included in the newly introduced syllabuses while implementing the National Education Policy, and (c) build long-term academic relationships between the participants and resource persons of various fields delivering talks in the workshop. The workshop brought together 30 participants involved in astronomy teaching and research in various colleges and universities of the North-Eastern region and nearby states. The inaugural talk of the workshop was delivered by Dhruba J Saikia of IUCAA which covered recent advances and prospects in the era of multi-messenger astronomy. It was attended by Hiralal Duorah, retired Professor of Physics, GU and the former Vice-Chancellor of the University who founded the GU Observatory and introduced astronomy and astrophysics in colleges of Assam and in the University. Resource persons from Gauhati University, IUCAA, Assam University, Dibrugarh University, Tezpur University and Cotton University delivered interactive talks on stellar astrophysics, observational astronomy, solar system, galaxies and the intergalactic medium, gravitation and cosmology. The workshop had rigorous hands-on sessions which included usage of Stellarium, analysis of astronomical data through SDSS Sky Server and other virtual observatory tools and visualisation of concepts in stellar astrophysics through Modules for Experiments in Stellar Astrophysics (MESA). An observation session in the Gauhati University Observatory was also organised. Another interesting component of the workshop was a series of short talks delivered by the participants on topics which they are teaching. These talks were presented in front of the resource persons who interacted with the participants. The workshop was coordinated by Sanjeev Kalita (ICARD Coordinator, GU), Dhruba J Saikia (MMTTC, ACE, IUCAA) and Sowgat Muzahid (IUCAA).

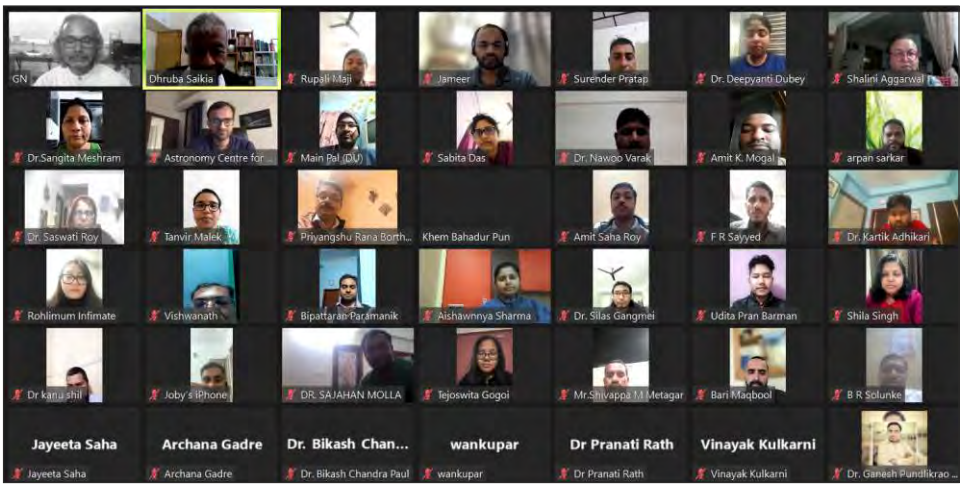
Astronomy, Science and Society

A workshop on the theme of Astronomy, Science and Society, was organised on 19th and 20th January 2024 at the Maratha Vidya Prasarak Samaj's Commerce, Management & Computer Science (C. M. C. S.) College, Nashik, by the Maharashtra State Faculty Development Academy (MSFDA) and the Astronomy Centre for Educators of IUCAA. The objectives of these workshops which are often held in smaller towns of Maharashtra are to bring the excitement of astronomy and science to faculty members across disciplines and also discuss broader issues related to science and society such as inclusiveness and non-discrimination. During this workshop Prakash Arumugasamy described the scales of the Universe, Moupiya Maji recounted the story of black holes, Jameer Manur introduced them to the night sky, while Dhruba J Saikia gave an overview of radio and x-ray astronomy and highlighted recent developments in India. In a separate talk,

he spoke on the importance of building inclusive societies drawing lessons from the history of astronomy. There was a night sky watching session led by Jameer Manur, and a bird watching session early in the morning led by Dhruba J Saikia. The participants enthusiastically took part in all the events. The workshop which had about fifty participants including resource persons and organisers was organised by Apurva Barve and Ajay Padvi from MSFDA and Team ACE, IUCAA.

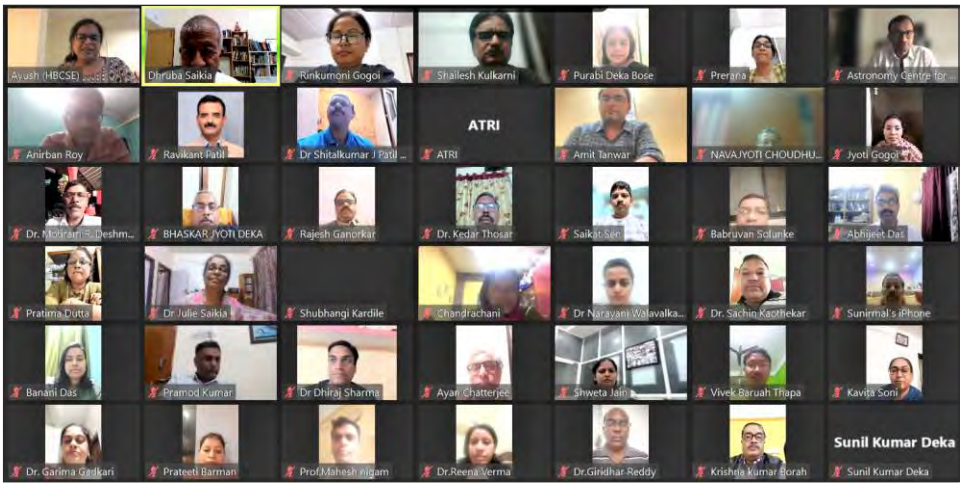
National Education Policy (NEP) Orientation and Sensitization Programmes

Two NEP Orientation and Sensitization Programmes under the Malaviya Mission Teacher Training Programme were held online from 1st to 15th February 2024, and 14th to 29th March 2024. For the February programme, the resource persons were G. Nagarjuna, IISER Pune, on holistic and multidisciplinary education; Mayank N Vahia, TIFR Mumbai, on Indian knowledge systems; Narayan C Talukdar, Assam down town University and K J George, IIT Jodhpur, on higher education and society; Dhruba J Saikia, IUCAA and Soumendra M Patnaik, University of Delhi, on academic leadership, governance and management; Sameer S Sahasrabudhe and Rohan Dasgupta, IIT Gandhinagar, on information and communication technology; Nilika Mehrotra, JNU, New Delhi and Deepa Chari, HBCSE, TIFR Mumbai, on student diversity and inclusive education; Farhat Naz, IIT Jodhpur and Sourav Pal, Ashoka University, Sonepat, on research and development; and N V Varghese, NIEPA, New Delhi and Mekin Maheshwari, Founder, Udhyam Learning Foundation, Bengaluru, on skill development.



A screenshot of a section of the participants from the 2024 February programme

The resource persons for the programme held in March 2024 were Hiten Choudhury, Cotton University and Prakash Arumugasamy, IUCAA, on information and communication technology; Sushruti Santhanam, Musician and Music Historian, and Vijay Singh, CEBS, Mumbai, on Indian knowledge systems; Ayush Gupta, HBCSE, TIFR Mumbai, on student diversity and inclusive education; Dhruba J Saikia, IUCAA and K J George, IIT Jodhpur, on higher education and society; Somak Raychaudhury, Ashoka



A screenshot of a section of the participants from the 2024 March programme

University, Sonepat and Padma Sarangapani, TISS, Mumbai, on holistic and multidisciplinary education; Maithreyi Ravikumar, Karnataka Health Promotion Trust, Bengaluru and C M Malish, IIT Bombay, on skill development; Javed Iqbal, former Director, Dr Reddy's Institute of Life Sciences, Hyderabad and Vijay Singh, CEBS, Mumbai on research and development; Ved Prakash, former Chairperson, University Grants Commission, and Furqan Qamar, former Secretary General, Association of Indian Universities, on academic leadership, governance and management.

Professor Ved Prakash, former Chairperson of the University Grants Commission, delivering a lecture on Academic Leadership, Governance and Management as part of the MMTTC, ACE, IUCAA programme on the National Education Policy Orientation and Sensitization on 20th March 2024

Visitors

Visitors [January – March 2024]

Rana Adhikari, Deepali Agarwal, Sajad Ahmad Ahanger, Shahzada Akhter, Shamim Akthar, Shadab Alam, G. Ambika, Kewal Anand, Simran Arora, Arif Babul, Satadru Bag, Suman Bala, Saptarshi Bej, Aru Beri, Tabasum Masood Bhat, Parag Bhattacharya, Sulagna Bhattacharya, Sree Bhattacherjee, Gautam Bhuyan, Sajad Ahmad Boked, Hritwik Bora, Anshuman Borgohain, Christian Braun, Shivam Burman, Subenoy Chakraborty, Sumanta Chakraborty, Nand Kumar Chakradhari, Hum Chand, Suchismito Chattopadhyay, Surajit Chattopadhyay, Bhag Chand Chauhan, Suraj Kumar Chaurasia, Khandro Chokyi, Anirban Chowdhary, Avijit Chowdhury, Pravat Dangal, Athar Ahmad Dar, Sikandar Akbar Dar, Mami Deka, Reshma Dessai, Ruchika Dhaka, P. P. Divakaran, Lokesh Kumar Duchaniya, Broja Gopal Dutta, Jibitesh Dutta, Anoma Ganguly, Surabhi Garg, Jogy George, Sandip V. George, Sushant G. Ghosh, Aritra Kumar Gon, Pranjupriya Goswami, Amar Nath Gupta, Ambey Gupta, Siddhartha Gupta, K.P. Harikrishnan, Srijita Hazra, Nazma Husain, Rinku Jacob, Sameer Jadhav, A.K. Jana, Akhila K., Anil Kakodkar, Sammi Kamal, Vinayak Kamble, Vinay Kashyap, Kartav Kesri, Nabendu Kumar Khan, Sheeraz Ahmad Khanday, Sowmya Krishnamurthy, Aman Kumar, Bijendra Kumar, Nagendra Kumar, Shivam Kumar, H. Lalthantluanga, Jeremie Lasue, Kushal Lodha, Santosh Kumar Lohakare, Mehak Mahajan, K. Mahapatra, Sunil Maharaj, Siddharth Maharana, Prakhar Maheshwari, Parvinder Maini, Sangita Maiti, Chandreyee Maitra, Soumak Maitra, Subhabrata Majumdar, Prajjwal Majumder, Manzoor A. Malik, Prajakta Mane, Manush Manju, Priya Mehra, Ajit Mehta, Swagat Mishra, Shikhar Mittal, Sajahan Molla, Rajesh Mondal, Soumen Mondal, Subroto Mukherjee, Shankar V. Nakhe, Supriya Narayan, Anand Narayanan, Vibin Narayanan V., Varun Nikam, Varuni P., Archana Pai, Manu Paranjape, K.D. Patil, Pravin Patole, Dusmanta Patra, B.C. Paul, Surajit Paul, Devraj Pawar, Jyoti Prakash, Ninan Sajeeth Philip, Anil Prabhakar, Arbind Pradhan, Ram Prasad Prajapati, Vanita Prasad, Niruj Mohan R., Sendhil Raja, Pranjal Ralegankar, Shrey Ramanujam, Pritesh Ranadive, Arshi Rastogi, Ankur Raut, Saibal Ray, Subharthi Ray, Asmita Redij, Vikram Rentala, Ashmita Roy, Bikash Chandra Roy, Rajesh S.R., Abhinaba Saha, Sanjay Kumar Sahay, Sunder B. Sahayanathan, M.V.S. Saketh, Arijit Sar, Seema Satin, Sindhu Satyavolu, Rikpratik Sengupta, Shiv Sethi, Zahir Ahmad Shah, Mohd Shahalam, Gauri Sharma, Paryag Sharma, Subah Sharma, Vaibhav Sharma, Sai D. Shetye, Ashutosh Singh, Pratyush Singh, T.P. Singh, Atreyee Sinha, Tomas Soltinsky, Ashima Sood, Sanjeeda Sultana, Hitesh Tanenia, Javaid Ahmad Tantray, Charis Tsakonas, Arman Tursunov, Shafqat Ul-Islam, Vishal Upendran, Muthumanimaran V., Nilkanth Dattatray Vagshette, Kartic Vaidyanathan, Himanshu Verma, Murli Manohar Verma, K. Vijayraghavan, P. Wilson, Anjum, Dharmender, Manikandan.

Long Term Visitors

- David Hilditch, University of Lisbon, Portugal. [Adjunct Faculty]
- Ashish Mahabal, CALTECH, USA. [Adjunct Faculty]
- Somak Raychaudhury, Ashoka University, Haryana [Adjunct Faculty]
- T. P. Singh, Ex- TIFR, Mumbai [Visiting Professor]
- Shamin Padalkar, [Honorary Visiting Position]

Khagol (the Celestial Sphere) is the quarterly bulletin of IUCAA

We welcome your feedback at the following address:

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