No. 117 | JANUARY 2019

KHAGOL

IUCAA
ISSN 0972-7647

A quarterly bulletin of the
Inter-University Centre for Astronomy and Astrophysics
(An autonomous institution of the University Grants Commission)

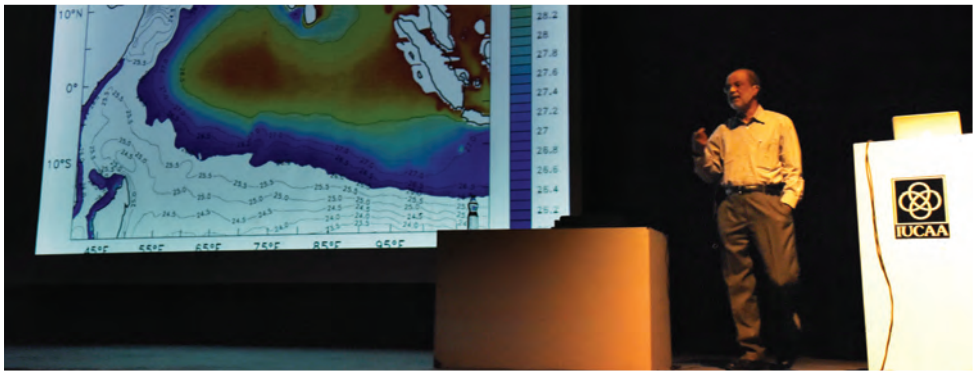
Editor :
Aseem Paranjape
(aseem@iucaa.in)

Editorial Assistant :
Manjiri Mahabal
(mam@iucaa.in)

Available online at http://publication.iucaa.in/index.php/khagol
Follow us on our face book page : Inter-University Centre for Astronomy and Astrophysics

The 30th IUCAA Foundation Day Lecture

Contents...



The 30th Foundation Day Lecture of IUCAA was delivered by Professor Satish R. Shetye on December 29, 2018 in the Chandrasekhar Auditorium. The title was, 'Physics of the Monsoons over India and Surrounding Seas: A Primer'.

In his Lecture, Professor Shetye gave a detailed, pedagogical and very informative exposition of the basic physical processes underlying the Indian monsoon. The monsoon is a very complex phenomenon involving the interaction of multiple geophysical and atmospheric effects, and he expertly guided the audience through these complexities in an illuminating and accessible talk.

Prof. Shetye is an eminent geophysicist and oceanographer and is an expert on monsoon-driven currents along the Indian coast. An alumnus of the IIT-Bombay, Prof. Shetye completed his Ph.D. in Physical Oceanography from the University of Washington, Seattle, USA in 1982. Thereafter, he returned to India to join the National Institute of Oceanography in Dona Paula, Goa, with which he was associated throughout his career in various capacities, including serving as its Director during 2004-2012. Prof. Shetye holds a number of academic distinctions including being a Fellow of all three major Indian Science Academies and the recipient of the Shanti Swarup Bhatnagar Prize for Earth, Atmosphere, Ocean, and Planetary Sciences awarded by the CSIR in 1992.

Congratulations to . . .

Varun Sahni, on being awarded the ***J.C. Bose Fellowship***, by the Department of Science and Technology, Government of India.

Surhud More, on being awarded the ***2019 Marshak Lecturership of the American Physical Society.***

After a brief historical overview of early (and incorrect) notions regarding the causes of the monsoon, he described the currently accepted theory. The monsoons arise due to seasonal and latitudinal (with the Sun) migration of the tropical rain-bearing belt (the doldrums) that encircles the tropics year around. During the winter, the belt lies well to the south of the region covering the Indian subcontinent and the seas around it. During the summer, the belt migrates to this region. The extent of this migration is rather large as compared to that seen over other tropical areas and is accompanied by local modifications of the rain-bearing belt.

Professor Shetye also emphasized that these modifications have features that were not found elsewhere in the world and occur, at least in part, due to the interaction between the atmosphere and the North Indian Ocean. The structure of mountains in the lands surrounding the ocean also plays a role in influencing the interaction and determining the monsoon. Thus, the atmosphere, ocean, and land topography play a role, among other factors, in making the Indian monsoon phenomenon unlike anywhere else on the planet. The lecture ended with a question-and-answer session with the audience.

Welcome to . . .

Surhud More, who has joined IUCAA in July 2018 as an Associate Professor. He obtained his PhD from the Max Planck Institute for Astronomy at the University of Heidelberg in 2009, and did post-doctoral work at the Kavli Institute for Cosmological Physics at the University of Chicago (2009 - 2012), and at the Kavli Institute for the Physics and Mathematics of the Universe (Kavli IPMU) at the University of Tokyo (2012 - 2014). He was an Assistant Professor at Kavli IPMU during 2014 - 2018, and an Associate Professor from February 2018, before moving to IUCAA. His research focuses on cosmology, and formation and evolution of galaxies, both observationally and theoretically. Astronomical observations in the last couple of decades indicate that a large portion (~ 96%) of the energy density of the Universe is made up of two mysterious and poorly understood components: dark matter and dark energy. His research work has helped to understand the connection between the observable properties of galaxies and the dark matter clumps in which galaxies live. This has allowed the use of galaxies as shining beacons to explore the parameters that describe the dark Universe. He is a member of the Subaru Hyper Suprime-Cam Survey as well as the upcoming Large Synoptic Survey Telescope project, two ambitious projects which aim to map out dark matter in the Universe and understand dark energy.

Bari Maqbool Bhat, who has done BSc (2008), MSc (2010), MPhil (2012), and PhD (2017) degrees, all from the University of Kashmir, Srinagar. After PhD, he joined the Indian Institute of Astrophysics, Bengaluru, as a Post-doctoral Fellow (PDF) for a brief period before joining IUCAA as a PDF in October 2018. During PhD, his primary research interest was to study the X-ray irradiated accretion disc by using theoretical modelling and numerical calculations. This included studying the effects of X-ray irradiation on the outer regions of the accretion disc in low mass X-ray binaries and understanding the long term variability observed in X-ray binaries. Presently, his research interest is to study the energy dependent rapid temporal behaviour of black hole systems using the AstroSat data.

Farewell to . . .

J.N.H.S. Aditya, Post-doctoral Fellow, who left IUCAA at the end of his tenure.

Bhooshan Gadre, Research Scholar, who has joined the Max-Planck Institute for Gravitational Physics, Postdam-Golm, Germany, as a Post-doctoral Fellow.

Labani Mallick, Research Scholar, who has joined the Pennsylvania State University as a Post-doctoral Fellow.

Proposals for holding Workshops/Schools Outside IUCAA

Proposals to conduct workshops/schools in Astronomy and Astrophysics or related areas are invited from university departments/affiliated colleges and the same may be sent to the Administrative Officer, Core Programmes, IUCAA (email: aocp@iucaa.in), IUCAA. It is preferred that the application be sent by March 31, 2019 (for events to be conducted during August 2019 - July 2020), so as to be included in the academic calendar for the next academic year. However, in exceptional circumstances, applications may be forwarded to the Administrative Officer at any time.

The following details should be given while sending the proposals: (i) the title (topic), (ii) duration of the workshop/school, (iii) topics to be covered and number of lectures in each topic, (iv) the level of audience and their number, (v) the number and tentative names of resource persons expected, and (vi) a description of the facilities available and (vii) the budget estimates (clearly stating the support offered by the host university/institute).

It is generally expected that infrastructural facilities and accommodation to the participants as well as the resource persons will be provided by the host institution. Other expenses will be borne by IUCAA.

The proposers are encouraged to consult IUCAA faculty while framing the proposal.

Once the workshop/school is approved, IUCAA will nominate a coordinator from its faculty, who will interact with the organiser in relation to the academic programme, budget, and identifying and approaching the resource persons. Preference will be given to those proposal where the expected resource people are primarily the host University and/or from other Universities.

Professor K.S.V.S. Narasimhan Memorial Award

Professor K.S.V.S. Narasimhan was a frequent visitor at IUCAA. He had deep interests in Astronomy and Astrophysics and taught Mathematics and Statistics for three decades at The New College in Chennai. After his sad demise, his family has left a generous endowment for deserving students to help them embark on a research career and in this way contribute to the field he loved so much.

Applications are invited for the Professor K.S.V.S. Narasimhan Memorial Award from an Indian University student for financial support to attend International Astronomy meetings. The support will be limited to about Rs .70,000/- towards international travel/accommodation and/or registration fee. The student should have an invitation to either speak or give a poster presentation at the meeting, and be registered for a Ph.D. in Astronomy and Astrophysics (or related areas) with an Indian University.

The application should consist of: (i) Bio-data with communication e-mail address, (ii) Proof of acceptance of presentation, (iii) Abstract of the talk/paper to be presented, (iv) Estimate of the total cost, (v) Other sources of funding, if any, and (vi) A letter of recommendation from the Ph.D. thesis supervisor. Applications will be considered twice a year with deadlines March 31, and June 30, and should be sent by e-mail to The Administrative Officer (Core Programmes), IUCAA (aocp@iucaa.in).

IUCAA invites Research Scholars from Indian Universities / Colleges

IUCAA-NCRA Graduate School Courses

The IUCAA-NCRA Graduate School (conducted jointly with the National Centre for Radio Astrophysics (NCRA), Pune) is divided into two semesters (four terms) spread over one year. Each term is of roughly eight weeks duration. During the Graduate School, the Ph.D. students (Research Scholars) are taught relevant advanced courses in Physics and are also introduced to courses in Astronomy and Astrophysics (A & A). The Graduate School structure is given below. The number of teaching hours is shown in brackets after each course.

Semester I, Term I, From August second week to October first week.

01. Methods of Mathematical Physics I (21)
02. Introduction to Astronomy and Astrophysics I (14)
03. Electrodynamics and Radiative Processes I (14)
04. Quantum and Statistical Mechanics I (14)

Semester I, Term II, From October third week to December second week.

05. Methods of Mathematical Physics II (14)
06. Introduction to Astronomy and Astrophysics II (14)
07. Electrodynamics and Radiative Processes II (14)
08. Quantum and Statistical Mechanics II (14)

Semester II, Term I, From January first week to February fourth week.

09. Astronomical Techniques I (14)
10. Galaxies : Structure, Dynamics and Evolution (21)
11. Extragalactic Astronomy I (21)

Semester II, Term II, From March third week to May second week.

12. Astronomical Techniques II (14)
13. Interstellar Medium (14)
14. Extragalactic Astronomy II (14)
15. Project Work (During May - July).
16. Topical Course (for earlier batch of students) (<21)

1. The courses are designed, emphasizing the aspects which are directly relevant to A &A. It is assumed that unnecessary repetition of material, which is already taught at M.Sc. is avoided.
2. The syllabus provides enough avenues for topics which are of "local interest" to be included in the graduate school. This is necessary so that graduate students coming out of IUCAA/NCRA, not only have a comprehensive grasp of the A & A but are also aware of the key research areas in which these two institutions are concentrating at present. Detailed syllabus may be found in the **website: http://www.iucaa.in/ Academics --> Ph.D. Programme.**

If any of the Research Scholars from Indian universities/colleges are interested in attending any of these courses, they may contact: **The Administrative Officer, IUCAA, e-mail: aocp@iucaa.in.**

North-East Meet of Astronomers (NEMA-4)

The North-East Meet of Astronomers (NEMA - 4) was held at the Bipin Chandra Pal Seminar Hall of the Assam University, Silchar, during November 26 - 28, 2018. This meeting was organized by the Department of Physics, Assam University, in collaboration with IUCAA. After the felicitation of the dignitaries, the lamp lighting ceremony was held along with an inaugural song by the post-graduate students of the Department of Physics. The abstract of NEMA- 4 was unveiled by the dignitaries on the stage after the welcome address. The keynote address was given by Somak Raychaudhury (Director, IUCAA), on Astrophysics in India: Past, present and future.

The invited lectures were given by:

- Barin K. Dey (Tripura University), on Periodicities in solar features or activities.
- Sanjeev Kalita (Gauhati University), on Some astrophysical issues with the ΛCDM universe.
- Moon Moon Devi (Tezpur University), on Cosmic rays and extensive air showers.
- Asoke K. Sen (Assam University), on Results from some recent cometary space missions and ground-based studies.
- Monmoyuri Baruah (Assam Don Bosco University), on Study of the absorption edge of luminous supersoft X-ray sources.
- Gazi Ameen Ahmed (Tezpur University), on Computational modelling of analogues of non-spherical interstellar dust for light scattering studies.
- Biman J. Medhi (Gauhati University), on Astronomical polarimetry: Optical and NIR approach.

- Umananda Dev Goswami (Dibrugarh University), on Gravitational waves: A window on to the Universe.
- Pralay Kumar Karmakar (Tezpur University), on Dynamics of nucleus-acoustic waves.
- A. Senorita Devi (Assam University), on A detailed survey on the various models of ultra-luminous X-ray sources.
- Rupjyoti Gogoi (Tezpur University), on Investigating interstellar dust grains through correlation studies.

- Himadri Sekhar Das (Assam University), on Modelling photo-polarimetric characteristics of comets based on ground-based observations and recent space missions.
- Atri Deshamukhya (Assam University), on Inflationary cosmology: A critical look.

Apart from the invited lectures, there were 30 contributory lectures, and presentations by MSc students of the Department of Physics, Assam University. A cultural programme was organised by the students. The coordinators of the meeting were Ranjeev Misra (IUCAA) and Himadri Sekhar Das (Assam University).

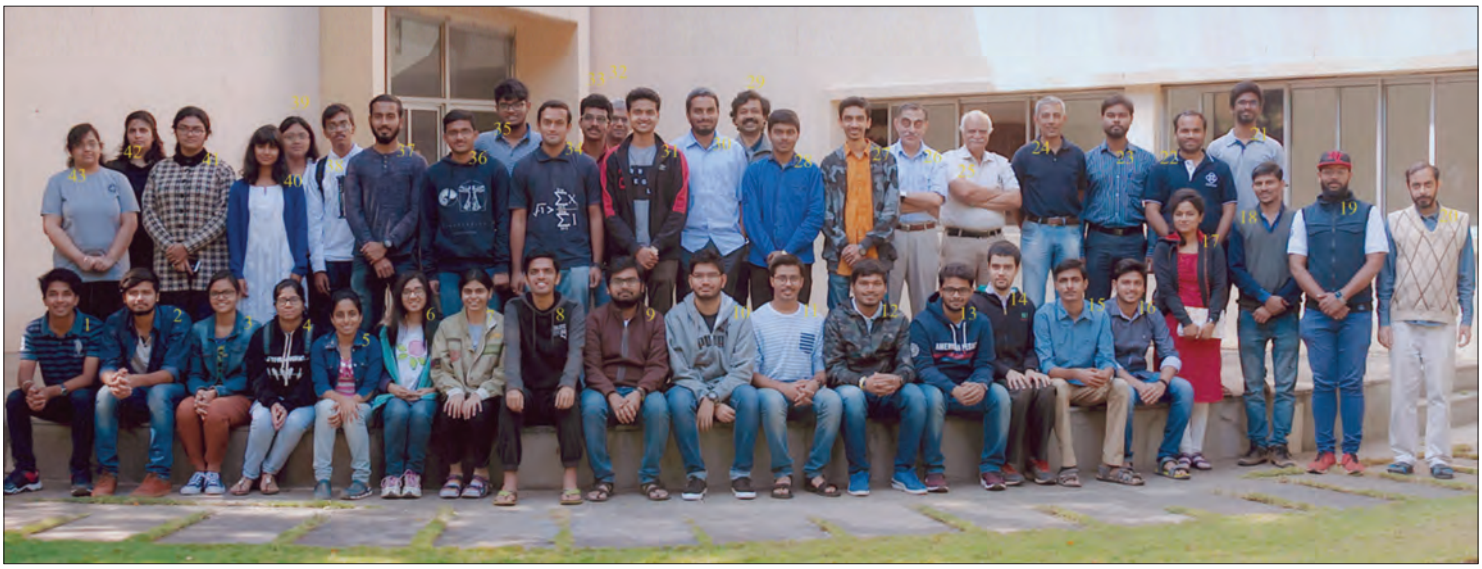
Workshop on Recent Advances in Astrophysics and Cosmology

The Workshop on Recent Advances in Astrophysics and Cosmology was held at the Department of Physics, Cooch Behar Panchanan Barma University (CPBU), during October 9 - 10, 2018, jointly organized by the IUCAA Resource Centre, University of North Bengal (NBU) and the Department of Physics, CPBU, and was sponsored by IUCAA. It was the first of its kind held at CPBU, and mainly meant for BSc and MSc students, research scholars and faculty members of that region. It was inaugurated by the Vice Chancellor of CPBU, Debkumar Mukhopadhyay. There were 91 participants. The speakers were: S. Mukherjee (IRC, Kolkata), B. C. Paul (NBU), Kanak Saha (IUCAA), Farook Rahaman (Jadavpur University), Mehedi Kalam (Aliah University), and Sk. Monowar Hossain (Aliah University). A special session was devoted to contributory papers. A number of topics such as: Model of the Universe, Cosmological Observations, Neutron Star, Evolution of Galaxies, Wormhole, etc. have been discussed. B. C. Paul (NBU), Prabir Kumar Haldar (CPBU), and Kanak Saha (IUCAA) were the coordinators.

Introductory Workshop in Astronomy and Astrophyiscs

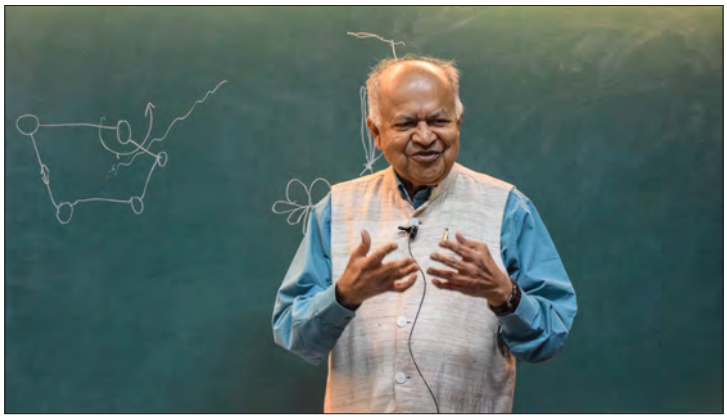
In association with IQAC Digboi College and the Department of Physics, Tezpur University, sponsored by IUCAA, the Introductory Workshop on Astronomy and Astrophysics was organized by the Department of Physics, Digboi College, during November 30 - December 1, 2018. The resource persons were: Ranjeev Misra (IUCAA), Gazi Amin Ahmed (Tezpur University), Gautam Saikia (Tezpur University), and Anshuman Buragohain (Tezpur University). There were 70 participants, consisting of 60 from the host institution (Digboi College), and 10 from the neighbouring Tinsukia College, and they had a good exposure to the field of Astronomy through the workshop. There were highly interactive lectures as well as demonstrations. The feedback of the participants clearly indicated that the workshop has been successful in generating a high level of interest in the field of Observational Astronomy.

IUCAA-NCRA Radio Astronomy Winter School 2018



Radio Astronomy Winter School (RAWSC) has been organized every year jointly by IUCAA and NCRA. The school is largely meant for under-graduate students in science pursuing BSc (Physics/ Electronics/Astronomy) and Engineering (BE/BTech). Through lectures and hands-on radio astronomy experiments, the school exposes participants to various astronomy fields in general and radio astronomy in particular. Over last ten years, the school has been immensely popular, and so far such schools have been organized since 2008. The schools such as this are extremely important for attracting bright students to astronomy, particularly in the wake of Indian astronomical community embarking on several mega-projects such as SKA, TMT, and LIGO - India.

The 11th RAWSC was organized during December 14 - 24, 2018. About 30 students from various colleges across the country participated in the school. The school was inaugurated by Somak Raychaudhury, Director, IUCAA and Yashwant Gupta, Centre Director, NCRA The main focus of the school was the hands-on experiments set up at IUCAA and NCRA Radio Physics Labs, which were: (i) Observations of the Sun using the 4 m telescope to determine the antenna power pattern, (ii) Observations of HI 21 cm line to observe neutral hydrogen from the Galaxy (using 4 m telescope and conical horn antenna), (iii) Characterization of super-heterodyne receiver, and (iv) Understanding noise fundamentals through Johnson noise. For these experiments, the students were arranged into five groups. The school also had lectures on astronomy by Joydeep Bagchi (IUCAA), on Galaxy Clusters, Divya Oberoi (NCRA), on Sun, Surhud More



(IUCAA), on Error Analysis, Subhashis Roy (NCRA), on HI in the Galaxy, and Interstellar Medium, Prasanta Bera (NCRA), on Basics of Radio Emission, Bhal Chandra Joshi (NCRA), on Co-ordinate Systems, Poonam Chandra (NCRA), on Radio Transients, Ishwar Chandra (NCRA), on AGN, Dipanjan Mitra (NCRA), on Pulsars, Ranjeev Misra (IUCAA), on High Energy Astronomy, Sanjeev Mitra (NCRA), on General Relativity, and Yogesh Wadadekar (NCRA), on Upcoming Telescopes.

On the last day of the school, the students presented results of their experiments. The presentations were organized in such a way as to allow exhaustive discussions on the methods used to carry out the observations/experiments and derive the results and their errors. A quiz competition, to test the overall understanding of astronomy and astrophysics was also organized. From the feedback of the students, we believe that students thoroughly enjoyed their first exposure to "serious" observing and experimentation!

The highlight of the school, of course, was the trip to the Giant Metrewave Radio Telescope (GMRT), and a special motivational session with Professor Jayant Narlikar, which was organized specially to celebrate the 10th anniversary of the Radio Physics Lab. Professor Narlikar shared his experiences with nice stories and events of his research career. The winter school was coordinated by Neeraj Gupta (IUCAA) and Subhashis Roy (NCRA).

Colloquia

04.10.2018: **Petri Vaisanen,** on *Time stamping starbursts in interacting galaxies with SALT and other telescopes.*

19.10.2018: **Surhud More,** on *Cosmological constraints from the Subaru Hyper Suprime-Cam Survey.*

01.11.2018: S. **Bhattacharya,** on *Rolling and stumbling: Granular self-organization by auto-tuning of friction.*

22.11.2018: **Robert Ward,** on *Instrumentation for the future of gravitational wave astronomy.*

27.11.2018: **Kunal Mooley,** on *The first EM counterpart of a gravitational wave event.*

29.11.2018: **Gulab Chand Dewangan,** on *X-ray/UV emission from AGN central engines.*

06.12.2018: **Dharam Vir Ahluwalia,** on *Deciphering what can exist (a la Wigner).*

Seminars

24.10.2018: S. **Rathna Kumar,** on *Measuring accurate time delays and simple analytical modelling of lensed quasars.*

31.10.2018: **Prasun Dhang,** on *A numerical study of MRI driven dynamo in rotating accretion flows.*

06.11.2018: **Upasana Das,** *on Instabilities in strongly magnetized accretion disks and jets.*

14.11.2018: **Debika Chowdhury,** on *Primordial magnetogenesis and non-Gaussianities.*

28.11.2018: **Deepak Pandey,** on *From macroscopic to microscopic optical resonators: Towards bridging the quantum and classical technologies.*

12.12.2018: **Jyotirmay Paul,** on *Design and development of an adaptive optics system in visible and near-infrared for IUCAA 2 metre telescope.*

19.12.2018: **Nishant Kumar Singh,** on *Solar magnetism and its effects on surface gravity modes: Implications for space weather.*

Public Outreach Activities

Tenth Anniversary of Chandrayaan I and International Observe the Moon Night

On the occasion of 10th anniversary of launch of Chandrayaan I, a special public lecture was delivered on October 22, 2018 by Suresh Naik (Former Group Director, ISRO), on Chandrayaan I: Celebrating 10th Launch Anniversary. This was followed by the public sky-watching activity, celebrating the International Observe the Moon Night 2018. Around 250 people of different age groups attended and enjoyed the programme.

Srujan Batch -1

A three month programme, Srujan, was started as a part of Vigyan-Tarang Lab at MVS, IUCAA in August 2018. The first batch, consisting of 16 students (Classes 6 to 8 from Vidyapeeth High School, Pune) was successfully concluded on November 3, 2018. The programme has been designed for the school students of the age group between 13 and 15 years, where they can participate and design Science Toys for fun, and learn as a part of the activity. The students were given all the resources they need to build the toys and explore new things on their own. This gives them a sense that science is a part of their day-to-day life and not restricted to textbooks and exams.

PuLastya Science Festival

To commemorate the birth anniversary of Late Shri Pu La Deshpande, November 8, PuLastya Science Festival was organised during November 26 - 29, 2018, at IUCAA. The programme included day-time sessions for school students on astronomy without telescopes, and interaction with IUCAA PhD research scholars for the students to get the feel of doing research. There were 4 public lectures by Helen Mason (University of Cambridge), on Reaching for the Sun; Ajit Kembhavi (IUCAA), on History of Cosmology from Hubble's Law to Hubble - Lemaitre's Law; Surhud More (IUCAA), on Hunting for Planet 9 in Our Solar System; and Ashish Mahabal (CalTech), on Vedh, Badalatya Avakshacha (in Marathi), followed by sky-watching sessions, and these were delightful for public. In total, around 3,600 people visited IUCAA on this occasion.

Jan - Jan JNU

Jan-Jan JNU, an open day programme for school students was organised by Jawaharlal Nehru University, Delhi, on November 30, 2018. Sonal Thorve (IUCAA) presented the science outreach activities at IUCAA, and demonstrated science toys and astronomy experiments at the event.

Jignyasa

Agastya International Foundation, in collaboration with IISER, Pune, had organised the Jignyasa at IISER, Pune, during December 14 - 15, 2018. Rupesh Labade, and Tushar Purohit (both from IUCAA) coordinated the telescope exhibition. In the evening of December 14, a moon-watching session was organised for the student volunteers, at which about 150 students observed moon through the telescopes.

Meteor Shower Sky-watch

An overnight sky-gazing session along with a talk on meteor shower, and introduction to the universe was organised at Warananagar, by Warana Science Innovation and Activity Centre, Kolhapur, in collaboration with IUCAA SciPOP on the occasion of Geminid meteor shower, on December 15 - 16, 2018. About 350 school students along with their parents and teachers actively participated in observing the sky throughout the night. The programme was coordinated by Sonal Thorve and Maharudra Mate (both from IUCAA).

Science Toys Demonstration and Sky-watch

A full day workshop for science teachers of Marathi medium government schools was held at the Government School, Hinjawadi, Pune, on December 17, 2018. Thirty five teachers from different schools participated in the workshop. In the first half, all the teachers were given material kits to make a few toys. The selected toys were related to the existing science curricula of classes 8, 9, and 10, which will be helpful for the teachers in the classroom. The second half of the workshop was dedicated to Astronomy in the Geography and Science curriculum. In this session, along with gravity and seasons, the newly introduced topics like life-cycle of stars were elaborated in simple manner to help in teaching Astronomy at school level. The workshop was coordinated by Sonal Thorve and Maharudra Mate.

Basic Astronomy Lecture and Sky-watch

Followed by the basic astronomy lecture by Sanjeev Dhurandhar (IUCAA) at Annasaheb Awate College, Manchar, on December 20, 2018, there was a sky-watching programme for the college students. Five hundred students attended this session, in which moon-watch and introduction to the constellations were the key demonstrations coordinated by the IUCAA outreach personnel, Rupesh Labade, and Nilesh Pokharkar.

Other Regular Events

The Public Outreach group has conducted 9 basic astronomy workshops, 4 science toys workshops, 12 science park and campus visits, and 3 sky watch programmes during October - December 2018, with an approximate reach to about 1,800 people.

Second Saturday Lectures/Demonstrations

October 13, 2018: **Pradeep Kurulkar** (DRDO), on *Recent achievements in space technology.*

December 8, 2018: **Kaustubh Vaghmare**, and Kaushal Sharma (both from IUCAA), on *Artificial intelligence in astronomy.*

Other Public Lectures

December 4, 2018: **Saku Tsuneta** (National Astronomical Observatories of Japan), on *The Sun and life on planets.*

December 12, 2018: **Nils Andersson** (University of Southampton, UK), on *Catching Einstein's waves.*

All the lectures are available at our YouTube channel - **https://www.youtube.com/user/IUCAASciPOP/**

Visitors

(July - September 2018)

Oluwashina Adegoke, Priya Aggarwal, Dharam Vir Ahluwalia, Bobomurat Ahmedov, Nils Andersson, Shruti Animesh, Raghav Arora, Smeet Ashar, Abdul Aziz, Srikumar Banerjee, Samuzal Barua, Sudhanshu Barway, Tomaso Belloni, Anil Bharadwaj, Sabyasachi Bhattacharya, Maitraya Kanta Bhattacharyya, Yashpal Bhulla, K.G. Biju, Atreyee Biswas, Mahasweta Biswas, Shubhen Biswas, Virajith Boddapati, Koushik Chakraborty, Subenoy Chakraborty, Sumanta Chakraborty, Suresh Chand, Anirban Chanda, Suresh Chandra, Sruthy Chandran, Goutami Chattopadhyay, Surajit Chattopadhyay, Kshitij Chavan, Shreya Choudhary, Debika Chowdhury, Sourav Roy Chowdhury, Haeun Chung, Rohan Dahale, Santosh Damayyawar, Abhishek Das, Debaiudh Das, Dipanjana Das, Shyam Das, Susmita Das, Upasana Das, Bipash Dasgupta, Prathamesh Dash, Ujjal Debnath, Kabita Deka, Kunal Deshmukh, Sagar Dey, Prasun Dhang, P. P. Divakaran, Divyajyoti, Dinesh Dixit, Sourav Dutta, Bhuvana G. R., Shashikiran Ganesh, Blesson George, Prabir Gharami, Koushik Ghosh, Ritesh Ghosh, Shounak Ghosh, Tathagata Ghosh, Tuhin Ghosh, Gourab Giri, Kishore Gopalakrishnan, Kaustav Goswami, Pranjupriya Goswami, Milind Gowardhan, Mathew Graham, Shivappa B. Gudennavar, Ajesh Gulati, Pawan Kumar Gupta, Prateek Gupta, Suhani Gupta, Sunil Gupta, K.P. Harikrishnan, David Hilditch, K. Indulekha, Md. Sayeedul Islam, Joe Jacob, Ayush Jain, Tamanna Jain, Soumya Jana, Charles Jose, A.S. Joshi, Ravi Joshi, Kanti Jotania, Anusree K.G., Md. Mehedi Kalam, Mohan Kale, Kishor Kamble, Shashi Kanbur, Soumyodipta Karmakar, Divyanshu Katiyar, Nishikanta Khandai, Sheeraz Ahmad Khanday, Utkarsh Khandelwal, Rukaiya Khatoon, Tushar Koli, Ramasami Krishna, Sumeet Kulkarni, Nitesh Kumar, S. Rathna Kumar, Vedant Kumar, Y. Rohin Kumar, Richa Kundu, Sayan Kundu, Ioannis Kypriotakis, Cheng-Yang Lee, Sreelakshmi M., Ashish Mahabal, Riya Mallick, Soma MandaI, Yashodhan Manerikar, Helen Mason, Jose Mathew, Jessica McIver, Chandrakant Mishra, Nabendu Sekhar Mishra, Tanmaya Mishra, Asimpunya Mitra, Anupama Mohanan, Aditya Sow Mondal, Kunal Mooley, Karim Mosani, Sneha Prakash Mudambi, Pradip Mukherjee, Shubhabroto Mukherjee, S. V. Nakhe, Vishnu Namboothiri, Debasmita Nandi, Wrishik Naskar, Alekha Chandra Nayak, Rajesh Nayak, Rajaram Nityananda, Clifford Nxomani, Nagayoshi Ohashi, Devendra Ojha, Manjusha P. V., Vishal Pabboj, Vaidehi Sharan Paliya, Bibhudatta Panda, Deepak Pandey, Sanjay Pandey, Mahadev Pandge, P.N. Pandita, Manu Paranjape, Padmakar S. Parihar, Abhijeet Parkhi, K.D. Patil, Deepan Patra, Rohan Pattnaik, B.C. Paul, Nupur Paul, Surajit Paul, Devraj Pawar, Shawn Pereira, Ninan Sajeeth Philip, Khun Sang Phukon, Tanmay Poddar, Akshay Priyadarshi, Pavlos Protopapas, Manoj Puravankara, Farook Rahaman, Sendhil Raja, Bhavesh Rajpoot, Sandeep Rana, Adarsh Ranjan, Chayan Ranjit, Sujata Kundu Ranjit, Anjali Rao, B.S. Ratanpal, Divya Rawat, Javlon Rayimbaev, B. Eswar Reddy, Pinaki Roy, Robin Jacob Roy, Sambit Roychowdhury, Prabir Rudra, Bubbly S. G., Ayantika Saha, Shantanu Saha, Sanjay Kumar Sahay, Punyasloka Sahoo, Sameer Tanaji Salunkhe, Gauranga Charan Samanta, M. Sami, Divita Saraogi, Iftikar Hossain Sardar, Abdus Sattar, S. Seetha, Kazuhiro Sekiguchi, Soumitra Sengupta, T.R. Seshadri, Parth Shah, Vishant Shah, Isha Shailesh, Nigar Shaji, Arijit Sharma, Ramkishor Sharma, Ranjan Sharma, Satish Shetye, Aditya Singh, Akriti Singh, Manwinder Singh, Navpreet Singh, Nishant Singh, Suprit Singh, Vijay Singh, P. Sreekumar, Sharanya Sur, Prayas Sutar, Rajalakshmi T.R., Mitanshu Thakore, Sivarani Thirupathi, Neal Thomas, Lekshmi Thulasidharan, Peter Tino, Awadhesh Kumar Trivedi, Saku Tsuneta, Paniveni Udayashankar, Malavika Unni, Bhargav Pradeep Vaidya, S. T. Khaiminthang Vaiphei, Petri Sami Mikael Vaisanen, Vanzarmawii, Manoj Varma, Ramasamy Venugopal, Murli Manohar Verma, R. G. Vishwakarma, Robert Ward, and Khabbab Zakaria.

Visitors Expected

January 2019

Moumita Aich, University of Kwazulu-Natai, Durban, South Africa; Abhay Ashtekar, Institute for Gravitation and the Cosmos, Pennsylvania State University, USA; Anshuman Borgohain, Tezpur University; Nand Kumar Chakradhari, Pt. Ravishankar Shukla University, Raipur; Philip Charles, University of Southampton, UK.; Moon Moon Devi, Tezpur University; Jibitesh Dutta, North-Eastern Hill University, Shillong; Bhooshan Gadre, AEI-Hannover, Germany; Poshak Gandhi, University of Southampton, UK.; Prabir Gharami, Jadavpur University, Kolkata; Koushik Ghosh, University of Burdwan; Rupjyoti Gogoi, Tezpur University; Mubashir Hamid, Government Degree College, Kashmir; Martin Hendry, University of Glasgow, UK; Mathew Hilton, University of Kwazulu-Natal, Durban, South Africa; Rinku Jacob, The Cochin College, Kochi; Anusree K. G., Mahatma Gandhi University, Kottayam; Tejpreet Kaur, Panjab University, Chandigarh; Labani Mallick, Pennsylvania State University, USA; Suvadip MandaI, IISER, Kolkata; Dipanjan Mitra, NCRA, Pune; Pierluigi Monaco, University of Trieste, Italy; Rajesh Mondai, University of Sussex, UK; Hemwati Nandan, Gurukula Kangri University, Haridwar; Archana Pai, lIT-Bombay, Mumbai; Main Pal, Jamia Millia Islamia, Delhi; Divya Pandey, NIT, Bhubaneswar; Mahadev Pandge, Dayanand Science College, Latur; P. N. Pandita, IISc, Bengaluru; Uma Papnoi, Kanoria PG Mahila Mahavidyalaya, Jaipur; Ajith Parameswaran, ICTS-TIFR, Bengaluru; Khun Sang Phukon, IIT, Kanpur; R. S. Pranjal, IIT-Bombay, Mumbai; Frederick J. Raab, Caltech, USA; Divya Rawat, IIT, Kanpur; Subharthi Ray, University of Kwazulu-Natal Durban, South Africa; David Reitze, Caltech, USA; Sonali Sachdeva, Kavli Institute for Astronomy and Astrophysics, China; Parampreet Singh, Louisiana State University, USA; Koushik Sur, Jadavpur University, Kolkata; Lekshmi Thulasidharan, Central University of Tamil Nadu, Thiruvarur; Lakshmi Kant Tiwari, Teerthanker Mahaveer University, Moradabad; Gayathri V., IIT-Bombay, Mumbai; and J. S. Yadav, Ex-TIFR, Mumbai.

February 2019

Prasiddha Arunachalam, Rutgers University, USA; Naseer Iqbal, University of Kashmir, Srinagar; Avinash Khare, Savitribai Phule Pune University; Zahoor Ahmad Malik, University of Kashmir, Srinagar; Aaquib Manzoor, University of Kashmir, Srinagar; Abhisek Mohapatra, NIT, Bhubaneswar; Asoke K. Sen, Assam University, Silchar; Saran Shaju, Cochin University of Science and Technology, Kochi; and Ajay Sharma, University of Lucknow.

March 2019

Arunima Banerjee, IISER, Tirupati; Anusree C.V., Government College, Madappali; Sunil Chandra, Centre for Space Research, North-West University, South Africa; Ayan Chatterjee, Central University of Himachal Pradesh, Dharamshala; Preshanth Jagannathan, National Radio Astronomy Observatory, USA; Chanda Jog, IISc, Bengaluru; Manjusha P.V., Government College, Madappali; and Biplab Raychaudhuri, Visva-Bharati University, Santiniketan.

Khagol (the Celestial Sphere) is the quarterly bulletin of

IUCAA

We welcome your feedback at the following address:

IUCAA, Post Bag 4, Ganeshkhind, Pune 411 007, India.
Phone : (020) 2569 1414; 2560 4100 Fax : (020) 2560 4699
email : publ@iucaa.in Web page : http://www.iucaa.in/