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27th IUCAA Foundation Day Lecture

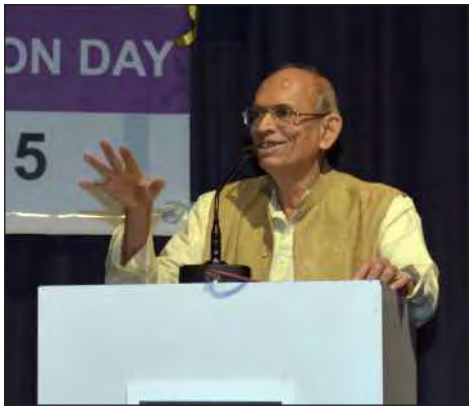
Introduction

The 27th IUCAA Foundation Day Lecture was delivered by the eminent Indian ecologist, Professor Madhav Gadgil on December 29, 2015. Over a career spanning more than four decades, Professor Gadgil has championed the effort towards the preservation of ecology in India, which includes establishing the Centre for Ecological Sciences under the aegis of the Indian Institute of Science, Bengaluru in 1983 and serving as the Head of the Western Ghats Ecology Expert Panel of 2010, popularly known as the Gadgil Commission. An alumnus of Harvard University, he is a recipient of the Padma Shri and Padma Bhushan from the Government of India, among several other accolades. In his Foundation Day Lecture, Professor Gadgil touched upon a number of issues relevant to the current state of ecological preservation in the country and their connection with the historical development of science and the growth of knowledge. An abstract of the Lecture follows.

Contents...

A Natural History of Knowledge

A naturalist lives today in a world of wounds, but for a connoisseur of knowledge, ours is a golden age; the challenge before us is to deploy the strengths of our age to heal the wounds. Life is an information-based, progressive and cooperative enterprise, evolving organisms capable of handling greater and greater quantities, of increasingly more complex information, ever more effectively. Social animals have taken this to new heights, with humans surpassing them, all thanks to the language abilities, and the greatly enhanced capacity to learn, teach, and to elaborate memes, including mythologies and scientific knowledge. Human knowledge has grown through interplay of seeking after truth, monopolizing knowledge and telling calculated lies. Humans recognize three main sources of knowledge: empirical observations (the earliest evidence being 34,000 years old archaeological records of astronomical observations), and divine revelations and uncontestable authority (as claimed for Vedas). The access to Vedas, supposedly the source of all knowledge, was traditionally restricted to high caste males, constituting a mere 6-10% of population. Rebelling against this Gautam Buddha, the rationalist, stated: Believe nothing, no matter where you read it, or who has said it; not even if I have said it, unless it agrees with your own reason. In response, the Bhagavadgita declares: a skeptical man will



be unhappy in this as well as the nether world. The ruling classes have always tried to keep the populace ignorant as preached by Laozi, a contemporary of Buddha: The people are hard to rule when they have too much knowledge. Therefore, ruling a state through knowledge is to rock the state. Ruling a state through ignorance brings stability to the state.

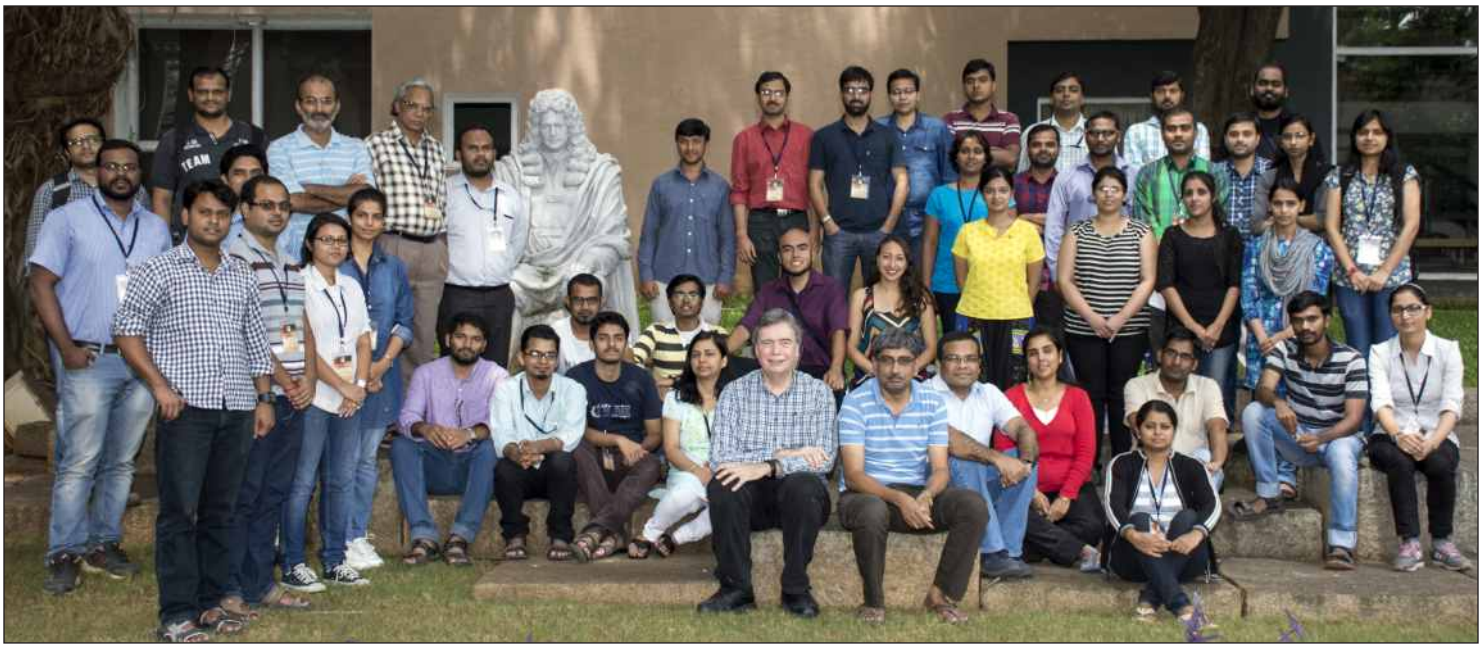
Modern science, the most successful of knowledge streams, rejects all authority other than that of objective observations /experiments, and logical inferences. It blossomed in 17th century Europe with scholars joining hands with artisans knowledgeable in practical arts, resulting in a union of three streams of thought and action: [1] Speculative thinking, [2] Deductive reasoning, and [3] Cut-and-dry or empirical experimentation. The chasm between practical arts and scholarship has remained ever wide in India, so that science could not take root here, while Europe,

developed science and science-based technologies permitting them to establish mastery over the rest of the world. Since sharing of information was vital to success of science, Europe moved in the direction of freedom of all information, with Sweden passing the Freedom of the Press Act in 1766. Regretfully, India continues to practice the Laozian doctrine that keeping people ignorant is vital to the stability of the state. One of the results is that all official channels for engagement of people in environmental monitoring are today blocked unconstitutionally. So knowledge about the status and dynamics of a variety of environmental parameters is not only incomplete and largely inaccessible to citizens, but replete with deliberate distortions.

Fortunately, thanks to Information and Communication Technology Revolution, Governments or moneyed interests no longer have a stranglehold on information. An important fallout of the ICT revolution has been the Free and Open Source Software movement, that has culminated in the tremendously successful Wikipedia enterprise. Wikipedia has rejected the hegemony of (the often not-so-honest) experts and encourages the participation of all citizens in the knowledge enterprise, aiming to make all knowledge of the world freely available to all people in their own languages. There are 21 Indian language Wikipedias, and they open up exciting possibilities engaging people at the grass-roots in a synthesis of scientific knowledge with their own experiential knowledge. This is a great opportunity to deploy the strengths of our age to heal the wounds of our age!

A recording is available at: https://youtu.be/WM2ITdjv_I4

CLOUDY Workshop



A workshop on quantitative spectroscopy and the plasma simulation code Cloudy was conducted at IUCAA during September 21 - 26, 2015.

Nearly all of the quantitative information now we have about the cosmos is the result of spectroscopy, the science of using spectra to make physical measurements. We can directly measure the temperature, density, pressure, or composition of a cloud of gas or a star, using a telescope and a spectrometer. The spectrum is formed in highly non-equilibrium gas and dust. Analytical theory cannot be used to understand the conditions, and so numerical simulations are required. Cloudy is a code that does this; it calculates the ionization, chemistry, radiation transport, and dynamics simultaneously and self consistently, building from a foundation of atomic and molecular

processes. The result is a prediction of the conditions in the material and its observed spectrum. These predictions depend on detailed atomic and molecular processes, and complicated, but is also why the spectrum reveals so much about its source.

The workshop was a mixture of classroom lectures focusing on the graduate textbook: *Astrophysics of Gaseous Nebulae and Active Galactic Nuclei* by Osterbrock and Ferland, application of Cloudy to sample problems, and group activities, in which participants have worked on research applications of their own choice. The IUCAA class site is given below, along with the participants list, a page giving interests and photos, the workshop agenda, and our Face Book group. Talks have been saved on this ftp site. There were 43 participants from around the world. They broke up into seven groups with posters giving their conclusions.

http://cloud9.pa.uky.edu/~gary/cloudy/CloudySummerSchool/2015_Pune/agenda2015Pune.html

Interface Region Imaging Spectrometer (IRIS) Data Analysis Workshop

An IRIS data analysis workshop, aimed at Ph.D. students and Post-doctoral Fellows was conducted at IUCAA during October 26 - 29, 2015. IRIS is a NASA mission that observed the Sun with high resolution imager as well as spectrograph. Analysis of the data from IRIS provides excellent overview and understanding of the coupling between the chromosphere and transition region. About 30 participants, including a few Visiting Associates of IUCAA from various universities, attended the workshop. Tiago Pereira and Boris Gudiksen, who are members of the core team of the IRIS mission, gave the lectures and tutorials. All the participants presented posters, and also gave short 15 minutes oral presentations based on their work they have been doing during their Ph.D. The students were divided into groups of four, and given projects based on the tutorials conducted during the workshop. The entire group did excellently well and they presented the results in the last day of the workshop. Durgesh Tripathi and Girjesh Gupta along with the local organizing committee conducted the workshop. Bart De Pontieu, the Principal Investigator of the IRIS mission, helped in suggesting the tutors from his team, and making the overall scientific programme of the workshop.

Indo-French Astronomy School for Optical Spectroscopy (IFSC2015)

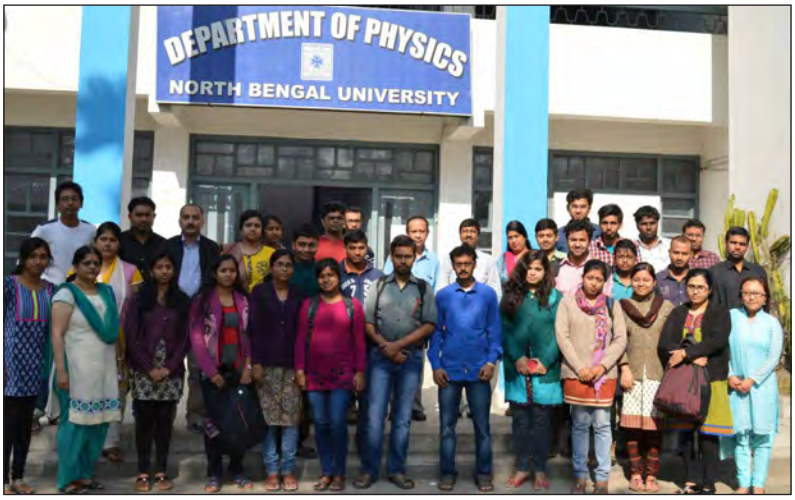
IUCAA and the Lyon Institute of Origins (LIO, Observatoire de Lyon, France) organized an Indo-French Astronomy School for Optical Spectroscopy (IFSC2015) at IUCAA, during November 23 - 28, 2015. The school was attended by about 35 participants, who were mainly Ph.D. students from India, and Pheneas Nkundabakura from Rwanda and Jose Gregorio from France. The resource persons were R. Srianand, Ranjan Gupta, Somak Raychaudhury, Aseem Paranjape, Neeraj Gupta A.N. Ramaprakash, Shilu Abraham, Sonali Sachdeva, Kaustubh Vaghmare (all from IUCAA), and Tanvir Hussain and H.P. Singh (both from University of Delhi) and Sunetra Giridhar from IIA, Bengaluru. The resource persons from University of Lyon, France were Philippe Prugniel, Yannick Copin, David Lagattuta, Mamta Pommier, and Sergi Blanco-Cuaresma from Geneva Observatory, Switzerland. The major topics covered in the morning sessions were: Introduction to Astronomical Spectroscopy, Spectrograph Design and Data Reduction, Spectroscopic Applications, Stellar and Galaxy Spectroscopy and Integral Field Spectroscopy. There were several evening talks on various other topics. Rest of the time was given to the participants to get hands-on experience of seven projects covering: Integral Field Spectroscopy, The MUSE/HUDF Tully-Fisher Relation, Spectral properties of optical hosts in radio galaxies, The Gaia Benchmark Stars, Automated Stellar Spectral Classification and Parameter Extraction, Lya Fluorescence Around a Radio Loud QSO and Using Long Slit Spectra from SALT-RSS to Study Stellar Populations in S0 Galaxies.

The school was covering the basics of optical spectroscopy up to the more advanced techniques like Integral Field spectroscopy. Hands-on sessions were provided to the participants to work with HST, MUSE, SALT, SNIFS and Gaia Benchmark Stars library data for their research projects. The participants appreciated the school and the tutorial sessions (on GALFITS and Elemental abundance from high resolution spectra) and these were extremely useful to them for their ongoing research work.

Ranjan Gupta, was the local coordinator, and French Coordinators were Philippe Prugniel and Mamta Pommier from University of Lyon.

Winter School on General Relativity and its Applications

The year 2015 being the 100th year of discovering the Theory of General Relativity (GR) by Albert Einstein, the Winter School, conducted at North Bengal University, Siliguri, during November 23 - 28, 2015 provided an opportunity to the researchers, students and young faculty on understanding GR and its manifold applications in Astronomy, Astrophysics and Cosmology. The purpose of school was to rekindle the interest of future stakeholders in this vast research area. There were 35 participants who came from different parts of India. There were lectures on basic topics: Tensor Analysis, Riemannian Geometry, General Theory of Relativity, Gravitational Waves, Compact Objects, Gravitational Collapse, Cosmology and X-Ray Astronomy. The participants felt that the School was very much useful for understanding GR and the recent developments.



The resource persons of the School were T. Padmanabhan (IUCAA), S. V. Dhurandhar (IUCAA), S. Mukherjee (IRC, Kolkata), S. Chakraborty (Jadavpur University), S. K. Ghosal (Formerly from NBU), S. Jhingan (JMI, New Delhi), S. Kar (IIT, Kharagpur), B. Paul (RRI, Bengaluru), B. C. Paul (NBU), and D. P. Datta (NBU).

T. Padmanabhan delivered a popular talk entitled: ***Gravity and Cosmos,*** where the participants and all the postgraduate students of the department participated actively.

The Coordinators were B.C. Paul, S. Jhingan, and Ranjeev Misra (IUCAA).

Workshop on Novae and Accreting Binaries: A Multi-wavelength Study

The workshop on Novae and Accreting Binaries: A Multi-wavelength Study was conducted during December 2 - 6, 2015, at the Centre for Excellence in Basic Sciences (CBS), University of Mumbai. The workshop was jointly organized by CBS and IUCAA, and was generously funded by Infosys Foundation. This was the first workshop held at CBS.

The aim was to provide an overview of research problems and to stimulate interest in this area of research among the participants. There were 58 participants from all over India, including faculty members, Ph.D. and M.Sc. students. The first two days were devoted to X-ray Binaries, and the next two days were on the Optical and IR Studies of Novae. On the last day of the workshop, the topics covered were Radio Studies of Quasars and Micro-quasars. Lectures were given by faculty members of CBS, IUCAA, TIFR, PRL, IIA, IIT (Kharagpur) and SNBNCBS. Besides lectures, an integral part of the workshop was data analysis demonstrations, and these were conducted in afternoon sessions. The coordinators for this workshop were Gargi Shaw from CBS, and RanjeevMisra from IUCAA. More details may be obtained from the link: http://cbs.ac.in/research/conferences/novae-and-accretion-binaries.

Workshop on Astronomy with Small Telescopes

School of Physical Sciences, S.R.T.M. University, Nanded, Maharashtra, has conducted a four day workshop on ***Astronomy with Small Telescopes*** during December 8-11, 2015. The workshop was jointly organized by IUCAA and S.R.T.M. University, and was attended by a total of 150 participants, which included 50 outstation participants from different parts of the country and 100 local students (M.Sc. M.Phil. and Ph.D.) Faculty members from the School have also participated actively in the workshop. The workshop was inaugurated by Pandit Vidyasagar, *Vice-Chancellor* of this university and N. M. Ashok, *PRL, Ahemadabad*, was the Chief Guest. The workshop started with a welcome address by M. K. Patil, Coordinator of the workshop, who briefly explained the theme of the workshop and discussed activities to be carried out.

As part of the workshop, a public lecture by **Padma Vibhushan Jayant Narlikar** was held on the topic ***Vishwat Aapan Ektech Aahot Ka? (Are We Alone in the Universe?)*** on December 8, 2015. This public lecture was intended to educate school, college students and the science loving people at large from Nanded city with a central theme of efforts in search of extraterrestrial life and was attended by more than 7000 people and was the unique event in the history of the University.

The resource persons for this workshop were Jayant Narlikar (IUCAA), S. K. Pandey (Pt. R. S. University, Raipur), N. M. Ashok (PRL, Ahmedabad), Yogesh Wadadekar (NCRA-TIFR, Pune), Padmakar Singh Parihar (IIA, Bangalore) and Kaustubh Waghmare (IUCAA). The topics covered were: (i) Some outstanding problems in cosmology, (ii) Teaching and research with small telescopes, (iii) Basics of telescopes, (iv) CCDs and Photometry, (v) Variable stars, (vi) Role of small telescopes in the Era of TMT and E-ELT's, (vii) Astronomical photometric data reduction techniques, etc.

Hands-on sessions were conducted in the afternoon sessions by Kaustubh Waghmare and Padmakar Parihar, and the participants got a flavour of astronomical image processing techniques, data analysis and photometry of stars. An evening colloquium by Tarun Souradeep, IUCAA, on the topic ***LIGO-India Project*** was also organized on December 9, 2015. M. K. Patil, Gulab Chand Dewangan and Varun Bhalerao were the coordinators of the workshop.

Workshop on General Relativity at its Centennial

Albert Einstein, on November 4, 1915, presented at the Prussian Academy of Sciences the first of four lectures about a covariant formulation to modify the Newtonian physics of the universal gravitation. Since then, General Relativity (GR) has not only passed all the tests it has been put through but has become the paradigm of any new theory of gravitation. To celebrate its centenary, a scientific meeting at the Centre for Theoretical Physics, Jamia Millia Islamia (CTP-JMI), New Delhi was organised during December 10 – 12, 2015.

The purpose of this school was to rekindle interest of graduate students, young researchers and faculty members in the area of general relativity. The speakers were chosen to cover different topics in general relativity. There was emphasis on Numerical relativity, gravitational waves and cosmology.

Over one hundred applications were received, and we could accommodate only 80 participants from all over India. Interaction with students during and after the meetings and the feedback was to hold such meetings regularly and for longer duration. The most appealing aspect was the broad areas of research in general relativity covered during lectures.

Luc Blanchet (IAP, Paris) gave an overview of historical developments in theories of gravitation from Newton to Einstein. He also summarized developments in our understanding of dark matter and alternative gravity theories. Romesh Kaul (IMSc, Chennai) discussed different variational formulations of GR. M. Sami (CTP, JMI) described various approaches, within and beyond GR, to explain the observed late time expansion of the universe. P. Ajith (ICTS, Bengaluru) gave an overview of gravitational waves. Harald Pfeiffer (CITA, Canada) gave two lectures on numerical relativity. He described the remarkable progress this area has made by showing simulations on binary black holes collisions, evolution of event and apparent horizon. T. Souradeep (IUCAA) gave a detailed presentation on developments in cosmology in pre and post Planck era. He conveyed the idea that era of precision cosmology has arrived. Sukanta Bose (IUCAA) described the time domain astronomy with gravitational waves. His lecture was an invitation to this new and exciting branch. He gave an overview of various initiatives India is taking in this direction. Gulab Dewangan (IUCAA) described X-ray probes of strong gravity near black holes in active galactic nuclei and X-ray binaries. He shared the excitement of newly launched ASTROSAT. Jerome Martin (IAP, Paris) gave a comprehensive survey of the models of inflation in cosmology in view of recently analysed Planck data. He showed how in this era of precision cosmology we can now rule out different models of inflation. This is pretty remarkable that through astrophysical observations we can constrain early universe (inflationary epoch), which lies beyond last scattering surface. B. S. Sathyaprakash (Cardiff. UK) talked about if black holes have memory. In his lecture he showed how by observing quasi normal modes of a deformed black hole, one can work out what caused the perturbation.

It was a fitting tribute to Einstein and general relativity on the occasion of 100 years of Einstein's field equations. Most of the important developments and exciting research directions for the future were discussed. The Coordinators were Sanjan Jhingan (CTP, JMI) and Sukanta Bose.

North East Meet of Astronomers - 2015

The Department of Physics, Tezpur University, organized the North East Meet of Astronomers - 2015, during October 26 - 28, 2015, and this was sponsored by IUCAA. There were 50 participants from different colleges/universities/institutions of the North Eastern states of India. The objective of the meeting was to bring researchers

of this region on a single platform to stimulate research, discussions and collaborations in Astronomy and related topics. There were senior researchers for expert comments and to show the future path of collaboration among astronomers of the region. There were a series of lectures delivered by young researchers and faculty members, followed by extensive discussions. The main topics were Astroplasmas, Black Holes, Infrared Astronomy, Gamma-ray Bursts, Interstellar and Cometary Dust, Cosmology, and Instrumentation. The meeting was also attended by Ranjeev Misra from IUCAA, and Asoke K. Sen from Assam University, Silchar.

The coordinators of this workshop were Rupjyoti Gogoi and Amit Pathak.

IUCAA-NCRA Radio Astronomy Winter School - 2015

Radio Astronomy Winter School (RAWS) has been organized every year, jointly by IUCAA and NCRA. The school is largely meant for under-graduate students in science, pursuing B.Sc. (Physics / Electronics /Astronomy), and Engineering (B.E./ B.Tech.). Bright and highly motivated high school/junior college students involved in amateur Astronomy, have been also encouraged to apply. Through lectures and hands-on Radio Astronomy experiments, the school exposes the participants to Astronomy in general, and Radio Astronomy in particular. The school has been immensely popular, and so far seven such schools have been organized since 2008. Such schools 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 and TMT.

In 2015, the RAWS was organized during December 15 - 24, 2015. There were 31 student participants from various colleges across the country. The school was inaugurated by Dipankar Bhattacharya from IUCAA. After the inauguration, Yogesh Wadadekar (NCRA), Raghunathan Srianand (IUCAA), Dipankar Bhattacharya, and Bhal Chandra Joshi (NCRA) gave lectures on topics related to propagation of electromagnetic waves, interaction between radiation and matter, detectors in astronomy and the basics of single dish radio astronomy.

The second and third days of the school were reserved for basic optics experiments and lectures on error analysis, and was conducted at IISER, Pune. This is the first time IISER, Pune has participated in organizing the school. At IISER, Prasad Subramanian, and K. Sasikumar Raja set up the demonstration of Callisto Spectrograph for observing Sun at radio frequencies. The activities at IISER concluded with a lecture on Radio Sun by Prasad Subramanian.

Over the next 5 days, the main focus of the school was hands-on experiments using 4 m telescope and an Antenna trainer kit at Radio Physics Labs at NCRA and IUCAA, and lectures covering the basics of Astronomy and Astrophysics. The hands-on experiments included (1) Observations of Sun with the 4 m telescope to determine the antenna power pattern, (2) Observations of HI 21-cm line to neutral hydrogen from the Galaxy, and (3) Measuring power patterns of various types of antennas using the antenna trainer kit. For these experiments, the students were divided into groups of 4-5,

and were provided excellent supervision by Jesu Raja and Ashok Kumar. The lectures on astronomy were delivered by Joydeep Bagchi (Active Galactic Nuclei), Poonam Chandra (Stellar Structure), HI in the Galaxy and Beyond (Neeraj Gupta), Bhal Chandra Joshi (Pulsars), Subhashis Roy (Interstellar Medium), and Raghunathan Srianand (Observable Universe). The highlight of this period, of course, was the trip to the Giant Metrewave Radio Telescope (GMRT).

On the last day of the school, the students presented the results from 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 errors. From the feedback of the students, we believe that students thoroughly enjoyed their first exposure to "serious" observing and experimentation! The last session of the school focussed on future of astronomy with lectures on Square Kilometre Array (Yashwant Gupta), The Thirty Metre Telescope (Raghunathan Srianand), and ASTROSAT (Dipankar Bhattacharya), and concluded with the announcement of the group with best presentation, and distribution of certificates and prizes by Dipankar Bhattacharya and Bhal Chandra Joshi. The coordinators of this school were Neeraj Gupta from IUCAA, and Subhashis Roy from NCRA.

Inviting Proposals for upcoming Workshops/Schools for 2016-17

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, by March 31, 2016 (for events to be conducted during August 2016 - July 2017), so as to be included in the academic calendar for the next academic year.

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 of resource persons available locally and the number of resource persons expected from IUCAA, 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.

Colloquia

03.12.2015

Henk Spruit ***on Magnetospheric accretion.***

08.12.2015

Nicholas Kaiser on ***Does gravitational lensing affect the cosmological distance redshift relation?***

22.12.2015

Bharat Ratra on ***Dark energy: Constant or time variable? (... and other open questions)***

Seminars

18.11.2015

Manasvita Joshi on ***Theoretical study of the effects of magnetic field geometry on the high energy emission of blazars.***

26.11.2015

Changbom Park on ***Cosmological constraints from the redshift dependence of galaxy clustering anisotropy: an alcock-paczynski.***

02.12.2015

Kunal Mooley on T***he search for radio afterglows of gravitational wave sources.***

09.12.2015

Tomaso Belloni on ***Black holes and neutron stars in our galaxy as laboratories for strong gravity.***

16.12.2015

Nishant Singh on ***A new precursor to solar active region formation.***

23.12.2015

Bharat Ratra on ***Cosmological seed magnetic field from inflation.***

... Farewell to

Pallavi Bhat, who has joined Princeton University, USA, as a post-doctoral fellow.

Sandipan Sengupta, who has joined IIT Gandhinagar as an Assistant Professor.

IUCAA Preprints

IUCAA preprints released during October - January can be obtained from the IUCAA library (library@iucaa.in). The preprints can also be freely downloaded from http://www.iucaa.in/~library/main.html.

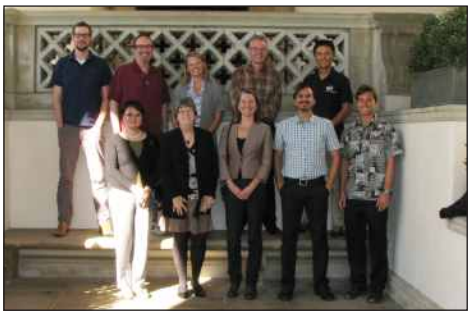
Highlights of Education and Public Outreach Programmes

Telescope Making Workshop

IUCAA was a partner in an 11-day, amateur reflecting telescope making workshop, organised by Vigyan Prasar, Government of India, in association with Pushpa Gujral Science City, Kapurthala, Punjab, during October 5 - 16, 2015, and 17 astronomy enthusiasts from various states participated. IUCAA intern, Tushar Purohit was a full time resource person, who gave instensive training about mirror grinding, polishing, etc. As a joint partner, ARIES, Nainital provided free facility for aluminisation of mirrors fabricated by the participants.

Samir Dhurde from IUCAA helped in planning and conducting a basic course in Astronomy and Astrophysics. The other resource persons were Arvind C. Ranade and Vipin Singh Rawat from Vigyan Prasar; Y. Ravi Kiron from Jawahar Planetarium, Allahabad; Ravindra Kumar Yadav from ARIES as well as Mukesh Satankar and Anil Dhiman, Amateur Astronomers from Bhopal. From the enthusiasm of the participants, it was inferred that the workshop was a great success, and they expected to conduct such workshops in futute very often.

TMT WEPOC Activities



IUCAA is a partner in the Workforce, Education, Public Outreach and Communications (WEPOC) initiative of the Thirty Metre Telescope International Observatory (TIO). Under the India-TMT WEPOC activities, Samir Dhurde put forth India's ongoing work and plans at the TIO Outreach Partners' workshop at California Institute of Technology, USA and the WEPOC meeting at the TMT head office held during November 7 - 13, 2015.

Looking forward to the fact that the next generation of students needs to get interested in working with TMT and becoming its future users, India-TMT WEPOC conducted an outreach related brainstorming session at the TMT-India Science and Instrumentation Meeting, held at Tezpur University, Assam, during December 1 - 3, 2015. Members of the science development team of India-TMT along with a few students took part in the discussion about the required tasks to be taken up. Austin Barnes from the University of California, Santa Cruz, USA also put forth the idea of developing a new international training programme for the Thirty Metre Telescope.

Here Comes the Sun

IUCAA Scipop group has been working on a Solar Astronomy outreach project with Helen Mason, Cambridge, UK. During her recent visit, a day-long teachers' workshop on using Solar Astronomy in their classrooms was conducted at IUCAA Muktangan Vidnyan Shodhika on November 28, 2015. The programme was coordinated by Samir Dhurde and Durgesh Tripathi from IUCAA, and there were 32 school teacher participants. Two Solar Astronomy activity sessions for 50 school students were also held at the MVS on November 30 and December 2. Also Helen Mason gave an inspiring talk to about 400 girl students of the St. Annes School, Pune on November 26, 2015.

Public Lecture

Bharat Ratra from Kansas State University, USA delivered an exciting lecture on Dark Matter, Dark Energy, Einstein's Cosmological Constant, and the Accelerating Universe on December 22, 2015. He lucidly explained why dark energy is the leading candidate for the mechanism that is responsible for causing the cosmological expansion to accelerate. The talk was attended by a diverse audience, who were all thrilled to see some hands-on explanations too on-stage and actively participated in the questions and answers session following the lecture.

Second Saturday Lectures

July : ***"Cosmic illusions"*** - J. V. Narlikar, IUCAA.

August : ***"How to infer the life story of a Galaxy?"*** - Kaustubh Waghmare, IUCAA.

September : ***"Wonderful light – Curious observations"*** - G. V. Pavan Kumar, IISER, Pune.

October : ***"Journey of a photon"*** - Durgesh Tripathi, IUCAA.

December : ***"Pluto unleashed"*** - Samir Dhurde, IUCAA.

Visitors

(October- December 2015)

Divyank Agarwal, D.V. Ahluwalia, Mohammed Altaf, Ayesha Anjum, Kalyani Bagri, Ayan Banerjee, Dipankar Banerjee, Srikumar Banerjee, Sumita Banerjee, Monmoyuri Baruah, Tomaso Belloni, Abhijit Bendre, Aru Beri, Yash Bhargava, S.G. Bhargavi, Shruthi Bhat, Sandip K. Bhattacharya, Sudip Bhattacharyya, Aparna Bisht, Ritabrata Biswas, Sergi Blanco-Cuaresma, H.B. Bohidar, Dipali Sadashiv Burud, Koushik Chakraborty, Subenoy Chakraborty, Sudip Chakraborty, Nabajit Chakravarty, Luke Chamandy, Avtar Chand, Vikas Chand, Ramesh Chandra, Sunil Chandra, Suresh Chandra, Ritaban Chatterjee, Tanmoy Chattopadhyay, Ankur Chauhan, Garima Chauhan, Manojendu Choudhury, Sumeet Chougule, Sreejith Chulliparambil, Yannick Copin, Himadri Sekhar Das, Sanskriti Das, Sukanta Das, Bipash Dasgupta, Raya Dastidar, Rumi Deb, P.P. Divakaran, Jayanta Dutta, Jibitesh Dutta, Somnath Dutta, Sourav Dutta, Savithri Ezhikode, Jose Gregorio Fernandez, Anjasha Gangopadhyay, Taparati Gangopadhyay, Sharad Gaonkar, Avyarthana Ghosh, Ritesh Ghosh, Somdutta Ghosh, Supriyo Ghosh, Suprovo Ghosh, Sushant G. Ghosh, Utkarsh Giri, Sunetra Giridhar, Rupjyoti Gogoi, Boris Gudiksen, Arijit Gupta, Prateek Gupta, Rasika Gupta, Tanul Gupta, Jaime Rosales Guzman, Mubashir Hamid, K.P. Harikrishnan, Sk. Monowar Hossein, Tanvir Hussain, K. Indulekha, Asif Iqbal, Rabiul Islam, Bala Iyer, Joe Jacob, Rinku Jacob, Dhairyashil Jagadale, Naman Jain, Gaurava Jaiswal, Rajeev Ratn Jaiswal, Chanda Jog, Sharda Keshav Jogadand, Reju Sam John, James Johnson, Manasvita Joshi, Navin Chandra Joshi, Kanti Jotania, Shyama Narendranath K.C., Nicholas Kaiser, Hiren Kakkad, Anil Kakodkar, Md. Mehedi Kalam, Dinakar Kanjilal, Pradip Karmakar, Nisha Katyal, Gurpreet Kaur, Tejpreet Kaur, Nirmala Kaushik, Keita Kawabe, Rakesh Khanna, Arup Kumar, Pankaj Kumar, Rahul Kumar, Shibesh Kumar, Suman Kundu, Kutty, Gokul L. Narayanan, Daniela Adriana Lacatus, David James Lagattuta, Smriti Mahajan, Atreya Majumdar, Anwesh Majumder, Shruti Maliakal, Jayawant Malkar, Abhijit Mandal, Krishnanjan Mandal, Pranshu Mandal, Soma Mandal, Sudip Mandal, H.S. Mani, Bari Maqbool, Helen Mason, Titus Mathew, Rakesh Mazumder, Ashish Mhaske, H. P. Milind, Alfred Molina, Sajahan Mollah, Aditya Sow Mondal, Aabha Monga, Kunal Mooley, Arunava Mukherjee, Sayan Mukherjee, Sargam Mulay, Sachindra Naik, K. Rajagopalan Nair, Nancy Narang, Mithun Neelakandan, Rajaram Nityananda, Pheneas Nkundabakura, Rahna P.T., Sanchita Pal, Biswajit Pandey, Mamta Pandey- Pommier, Mahadev Pandge, Kalpana Pandian, Rishikesh Pandit, P.N. Pandita, Dishant Pandya, Vaibhav Pant, Manu Paranjape, Dhruv Paranjpye, Ganesh Parida, Changbom Park, K.D. Patil, B.C. Paul, Biswajit Paul, Debdutta Paul, Devraj Pawar, Pramod Pawar, Tiago Pereira, Ninan Sajeeth Philip, Khun Sang Phukon, Umme Salma M. Pirzada, A.K. Poddar, T.V. Prabhakaran, Anirudh Pradhan, Ved Prakash, Philippe Prugniel, Mussadiq Qureshi, Farook Rahaman, Suvendu Rakshit, Pritesh Ranadive, A.R. Rao, Anjali Rao, B.S. Ratanpal, Bharat Ratra, Javlon Rayimbaev, Anthony Readhead, B. Eswar Reddy, Aditya Rotti, Shashank Roy, P.C. Sachin, Mradumay Sadh, Aindrila Saha, Sagnik Saha, Sourita Saha, Subhajit Saha, Gautam Saikia, Tarun Deep Saini, Tanmoy Samanta, Prasant Kumar Samantray, Shishir Sankhyayan, Prakriti Sardana, Aveek Sarkar, Himangshu Sekhar Sarmah, Pooja Sekhar, Anand Sengupta, Zahir Ahmad Shah, Aishawnnya Sharma, Kaushal Sharma, Rahul Sharma, Ranjan Sharma, Hrishikesh Shetgaonkar, Juie Shetye, Ajmala B. Shibina, Anvar Shukurov, Sunil H. S. Simha, Alkendra Singh, Amitesh Singh, H.P. Singh, K.P. Singh, Manju Singh, Mridweeka Singh, Neha Singh, Nishant Singh, T.P. Singh, Vir Singh, Akshat Singhal, Henk Spruit, P. Sreekumar, Akshaya Subbanna, Ravi Subrahmanyan, Pradeepta Sundaray, Sharanya Sur, Avinash Surendran, Ramya Suresh, Lunchakorn Tannukij, P. G. Thakurta, Pranjal Trivedi, Haris U., Santosh Vadawale, Nilkanth Dattatray Vagshette, D.B. Vaidya, Tanmay Verma, Savio Vincent, R.G. Vishwakarma, M. Vivek, Yogesh Wadadekar, Naveel Wani, Pitayuth Wongjun, Yue Wu, Zak Yacoob, Bal Krishna Yadav, Samyak, Shefali,

Visitors (Expected)

January 2016

Zeeshan Ahmed, University of Stanford, USA.; Atma Anand, IIST, Thiruvananthapuram; Sarmistha Banik, BITS-Pilani, Hyderabad; Sudhanshu Barway, SAAO, South Africa; Priya Bharali, Guwahati University, Assam; Naznin R. Choudhury, Assam University, Silchar; Rudrani Kar Chowdhur, West Bengal; Sanchari Das, Govt. College of Engineering and Ceramic Technology, West Bengal; Bipash Dasgupta, M. P. Birla Planetarium, Kolkata; Tirna Deb, Presidency University, Kolkata ; M. Elango, P.S.G. College of Arts and Science, Coimbatore; Poshak Gandhi, University of Southampton, UK; B. Hareesh Gautham, BITS-Pilani, Hyderabad; Alok Gupta, ARIES, Nainital; Naseer Iqbal, Univ., of Kashmir, Srinagar; Bhola Ishwar, BRA Bihar Univ. Muzaffarpur; Md. Sayeedul Islam, Jadavpur Univ., Kolkata; G. Vijay Kumar, P.S.G. College of Arts and Science, Coimbatore; Tabasum Masood, Univ., of Kashmir, Srinagar; Vivek Mishra, B.R.A. Bihar University, Muzaffarpur; Anurag Mishra, IIST, Trivandrum; Dishant Pandya, Pandit Deendayal Petroleum University, Gandhinagar; Harsh Prajapati, IET, Ahmedabad University; B. S. Ratanpal, The M.S. University of Baroda, Vadodara; Biplab Raychaudhuri, Visva-Bharati, Santiniketan; Namrata Roy, Presidency University, Kolkata; Priyanka Sahu, Dharmsinh Desai Univ., Gujarat; Vishant Shah, The M.S. University of Baroda, Vadodara; V. O. Thomas, The M.S. Univ., of Baroda, Vadodara; P. Udayashankar, NIET, Mysore; Naveel Wani, Univ., of Kashmir, Srinagar.

February 2016

Robi Banerjee, Sukanya Bhattacharya, Saha Institute of Nuclear Physics, Kolkata; Sami Solanki, Max Planck Institute , Germany.

March 2016

Mustansir Barma, TIFR, Mumbai; Pratibha Chauhan, Pacific Univ., Udaipur; D. P. Datta, University of North Bengal, Darjeeling; Rama Govindarajan, TIFR, Centre For Interdisciplinary Series, Hyderabad; Annat Jain, Pacific Univ., Udaipur; Kushhal Jain, Pacific Univ., Udaipur; Sheshmal Jain, Pacific Univ., Udaipur; Meenal Shirmali, Pacific Univ., Udaipur.

Long Term Visitor

Yogesh Wadadekar, NCRA, Pune.

Know Thy Birds 12

Black Drongo

- Chaitanya Rajarshi

Hello friends,

This time, let me introduce a *"Dabang"* (Fearless) bird to you. This aggressive bird plays the role of a *'Kotwal' (Police Inspector)* in bird community. It attacks much larger birds like crows, kites, birds of prey which enter into its territory. Due to this nature of drongo, other birds like doves, orioles, and yellow-footed pigeons prefer to nest in its neighbourhood.

Identification: Black Drongo is about 31cm long and as name suggests is utterly black (glossy) in colour. Its distinctive forked tail can be identified easily.

The males and females are alike. Juveniles are somewhat brown and have white bars on belly.

There are about 26 species in the family of Drongos (Genus: Dicrurus), however, about 8 species are found in India, and 6 in Maharashtra (Black Drongo, Ashy Drongo, White-bellied Drongo, Bronzed Drongo, Hair-crested Drongo and Greater Racket-tailed Drongo).

This *least concerned* bird is a common resident breeder in Indian sub-continent and also in the other parts of southern Asia. Drongo's flying ability is also remarkable as they can catch flying insects. They mainly feed on insects like cicadas, grasshoppers, bees, moths, dragonflies, butterflies, ants, etc. and seasonally on flower nectars, and grains. Drongos are good imitators. They imitate the call of a bird of prey like shikra to steal prey from birds like mynas.

Black drongos mainly breed around summer and monsoon. The nest is cup like structure built on fork of a tree branch.

Normally, three cream colour eggs with red spots are laid, which are incubated for two weeks.

You would see drongos sitting on grazing animals, thorny bushes, bare perches or electricity wires. Salute the *Kotwal Saab* when you spot it.

▲ **Black Drongo (*Dicrurus Macrocercus*); Marathi-Hindi: *Kotwal*, Gujrati: *Kaalo Koshee***
(Photo Courtesy: Umesh Vaghela)

▲ **Drongo in a nest.**
(Photo Courtesy: Umesh Vaghela)

Friends, winter is here and birds are calling you to watch their activities in the early morning or evening. So, please dodge from your warm blankets and explore around nearby with 8 x 40 or 10 x 50 binocular.

Wish You A Very
Happy Birding

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

We welcome your responses at the following address:

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