

# KHAGOL



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## IUCAA Foundation Day Lecture

The 23rd IUCAA Foundation Day lecture, titled **Energy, Environment, and Sustainable Development**, was delivered by Srikumar Banerjee, Chairman, Atomic Energy Commission, and Secretary, Department of Atomic Energy, Government of India. He pointed out that sustainable energy source is among the foremost challenges being faced by all developing countries. He highlighted the growth in Indian technology, and improvement in living standards, and emphasized on the energy generation rate that would be required to meet the aspirations of the Indian people in the future. The use of coal, natural gas, and other carbon-based energy sources, are believed to increase the fraction of greenhouse gases and enhance global warming and ozone depletion. Banerjee briefly described the non-carbon-based alternatives, such as solar, wind, and nuclear energy sources. Using various arguments, he proposed that nuclear energy generation is the possible sustainable solution to make up for the large deficit between the required power generation, and what could be achieved by continuing with the current energy generation methods. He explained the Indian Nuclear Energy Programme, the technology of nuclear energy generation, nuclear fuel used, and the various nuclear reactors that are operational in the country. Banerjee discussed the cost effectiveness and viability of nuclear energy source, and touched upon the risks and precautions regarding the nuclear programme.



**Srikumar Banerjee** delivering the  
23rd IUCAA Foundation Day Lecture

## Sanjeev Fest



Sanjeev Dhurandhar recently chose to retire from IUCAA at a tender age (!) of sixty, after many glorious years at the international frontiers of research in gravitational waves (GW). Over two decades, Sanjeev placed India prominently on the world map of GW research. He has been the leader of the only Indian group in the LIGO (Laser Interferometer Gravitational-wave Observatory) Science Collaboration (LSC) for the past decade. He also trained a large number of top-notch doctoral students and post-doctoral researchers, who now occupy important positions within the international GW community. Thanks largely to his stellar career, the current generation of Indian

scientists are in a position to envisage an unprecedented mega-science project on Indian soil of setting up an advanced GW observatory, dubbed, LIGO-India championed by the IndiGO (Indian Initiative in Gravitational - Wave Observations) consortium.

The young researchers, who have recently started returning to faculty positions in India, have already initiated a consolidated pan-Indian participation of data analysts, theorists and experimenters in the LSC, and also plan to set up an international LIGO data analysis centre at IUCAA.



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To celebrate and felicitate Sanjeev Dhurandhar on this momentous occasion, IUCAA organised an afternoon of talks and tributes on December 20, 2011, which was a part of the ICTS workshop on Gravitational Wave Astronomy. The meeting was attended by top international GW researchers, in particular, Kip Thorne, who is universally acknowledged as a father figure in the field of GW research. The proceedings opened with warm words of praise from Kip Thorne. Former supervisor, Jayant Narlikar, and Naresh Dadhich who has been a friend and mentor, made humorous and insightful observations on Sanjeev's early career. The LIGO laboratory represented by their Director, David Reitze; Chief Scientist, Stan Whitcomb; and Gabriella Gonzalez, Chair of LSC added their words of tribute and appreciation for the significant contribution made to LIGO laboratory and LSC. B. S. Sathyaprakash, a leading international GW researcher at Cardiff University, recalled the stimulating start of his GW career as post-doctoral fellow of Sanjeev in the early years of IUCAA. Similar sentiments were also expressed by Sukanta Bose, a former postdoc, and currently, a faculty member in University of Washington, Pullman. There were also talks by former students, Archana Pai, Anand Sengupta and Sanjit Mitra, all of whom



have recently returned to faculty positions in India after post-doctoral years at top GW research groups.

The event was followed by a fabulous public lecture by Kip Thorne entitled **"The Warped Side of the Universe"** at the IUCAA

Chandrasekhar Auditorium. This talk, on the status and prospects of gravitational waves research, was the second in the series of Chandra lectures being organized by IUCAA, and was very well attended.

The touching felicitation event for Sanjeev was the brainchild of Ajit Kembhavi, who regaled the audience with humor while talking about the relatively less known work on tachyons and white holes carried out by Sanjeev during his doctoral years. Bala Iyer, from RRI, another contemporary doyen of GW research in India and a close colleague of Sanjeev, coordinated the scientific programme, gave a talk laced with early memories. He also read out parts from the felicitation messages sent by numerous collaborators and colleagues of Sanjeev Dhurandhar from around the world. The execution and organization of the meeting was coordinated by Tarun Souradeep.

## ICTS Workshop on Gravitational Wave Astronomy

Gravitational Waves research in India has a twenty-year legacy and wide recognition in the international GW community. Several studies have pointed out that the optimal location for another detector to augment the sensitivity of the current global network lies in the Indian Ocean region with India as a very good choice. The GW International Committee's (GWIC) Road Map Document strongly supports the GW experimental effort in India. A scientific collaboration, called the Indian Initiative in GW Observations (IndIGO), formed to launch a major initiative in a promising experimental research frontier has submitted the LIGO-India proposal for the construction and joint Indo-US operation of an advanced GW detector on Indian soil in collaboration with LIGO labs, USA. LIGO-India provides Indian science with a remarkable opportunity to conduct frontline, large scale experimental research. A workshop was organised during December 20–22, 2011, at IUCAA, as part of the 'Frontiers of Cosmology and Gravitation' programme of the International Centre for Theoretical Sciences (ICTS) to review the LIGO-India proposal, in the presence of international GW community, and LIGO directorate. The workshop brought senior members of international GW community such as Kip Thorne; LIGO Director, David Reitze; Chief Scientist, Stan Whitcomb; and LIGO science collaboration members, director and representatives of key Indian institutions that would like to co-partner with IUCAA in the LIGO-India, and key IndIGO consortium members for two days of intense meetings and deliberations. The workshop provided a timely crucial platform for a meeting of all interested parties, where many aspects of LIGO-India campaign were refined. The meeting was jointly coordinated by B. S. Sathyaprakash (Cardiff University), Bala Iyer (RRI) and Tarun Souradeep.





## International Virtual Observatory Alliance Interoperability Meeting



The 20<sup>th</sup> International Virtual Observatory Alliance (IVOA) Interoperability meeting was held from October 17 to 21, 2011 at IUCAA. The meeting was jointly hosted by IUCAA and Persistent Systems Ltd (PSL), Pune, who are co-investigators in the Virtual Observatory India project.

About 80 participants from 12 countries attended the meeting. Most of the participants were from countries having their own Virtual Observatory projects as members of the IVOA. There were also participants from institutes in India, such as Birla Institute of Technology and Science (BITS) and Indian Institute of Science (IISc). The participants used this opportunity to showcase the work done by their respective Virtual Observatories since the previous

Interoperability meeting held in Naples, Italy (May 2011). Various proposals for creating new standards and updating the existing standards were also discussed during the meeting.

The IVOA holds two Interoperability Workshops each year in different IVOA member countries, typically in May and October. These meetings are opportunities for the IVOA Groups and Committees to have face-to-face discussions. The InterOp meeting is preceded by meetings of the IVOA Executive Committee and the Technical Co-ordination Group (TCG).

New technical developments and their scientific applications was the agenda of the InterOp meeting. There were two plenary sessions: one each at the beginning and end of the workshop, which were attended by all the participants. Most of the sessions were held in parallel by various Working Groups (WG) and Interest Groups (IG) such as Applications, VOTable, VOEvent, Data Model, Query Language, Registry, to name a few.



### Congratulations to ...

**Naresh Dadhich**, for an invitation to take up the newly instituted M. A. Ansari Chair at the Jamia Millia Islamia, Delhi. The Chair will be hosted in the Centre for Theoretical Physics with a tenure of 3 years.

**Jayant Narlikar**, on being conferred with the Sri Chandrasekarendra Saraswathi National Eminence Award by South Indian Education Society (SIES), Mumbai.

**T. Padmanabhan**, on being conferred with the TWAS Prize in Physics for 2011 by Third World Academy of Sciences.

**Arvind Paranjpye**, who has joined the Nehru Science Centre, Mumbai, as the Director (Planetarium) from December 22, 2011.



## Workshop on Teaching and Research with Small Telescopes



A workshop on Teaching and Research with Small Telescopes, sponsored by IUCAA was organized at J.E.S.College, Jalna, during October 17-19, 2011. This was the fourth workshop evolved through the academic association of J.E.S. College, Jalna, with IUCAA during the past two decades. A 12" optical telescope was installed at the college with the support of the Department of Science and Technology, Government of India, in 2001, for undertaking astronomical research, mainly on variable stars. The workshop was organized with a view to provide an opportunity of interaction for small telescope users in colleges, universities and other organizations in the country with experts in this field. Participants included 25 faculty members from colleges, universities and planetaria, 7 Ph. D. and 14 M. Sc. students. They were from Maharashtra, Odisha, Gujarat, Karnataka, Rajasthan, Andhra Pradesh, Uttar Pradesh, Manipur and New Delhi. Ranjan Gupta (IUCAA) delivered lectures on importance of small telescopes in Indian context, optical telescopes and detectors, astronomical photometry, new telescopes in this century. Arvind Paranjpye (IUCAA) talked on asteroids - their searches and observations, virtual observatories, and the use of World Wide Telescopes in teaching astronomy. He also arranged a demonstration session 'hands-on tips for using small telescopes' on the 12" Meade telescope of J.E.S. College. T. Chandrashekhkar from PRL, Ahmedabad, spoke on occultations of asteroids and observing lunar transit events using small telescopes as well as on lunar occultations. N. M. Ashok from PRL, Ahmedabad, gave an extensive talk on the study of variable stars using small telescopes. H. P. Singh from Delhi University elaborated about determination of fundamental parameters of stars. Arvind Ranade from

Vigyan Prasara, Noida, gave a presentation on Venus Transit 2012. M. L. Kurtadikar from J.E.S. College, presented an account of work done by the group, using small telescope in the past decade. He discussed the present status of teaching and research using small telescopes, emphasizing on enhancing the research contribution of small telescope users in the country.

During panel discussion, the resource persons, Ranjan Gupta, T.Chandrashekhkar, N. M. Ashok, Arvind Paranjpye and M. L. Kurtadikar exchanged their views with the participants on the theme of the workshop. Need of introducing topics on Astronomy in the curricula at different levels from school to graduate and postgraduate levels was emphasized. It was the general consensus that much needs to be done to

enhance the present status of research using small telescopes in the country. It was also urged that there was a need for coordinating the activities and research efforts of small telescope users in the country with the help of institutes like IUCAA. A few small telescope users presented the observational work being done at their centres during the participant presentation session. Observational sessions were conducted by Arvind Paranjpye, and local users of the small telescope at J.E.S. College. P. M. Kokne, R. S.Yannawar, A. N. Ardad, A. D. Dashrath, and S. K. Pandit assisted in operating the telescope.

The workshop was inaugurated by Vijay Pandharipande, Vice-Chancellor, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad. S. C. Mehrotra of the University was the Guest of Honour. P.R. Bagadia, President of Jalna Education Society, S.G. Bhakkad, Secretary of the Society and Principal Ramesh Agrawal shared their views with the participants. S. K. Popalghat, Vice-Principal of the College and Head, P.G. Department of Physics felicitated the resource persons in the concluding function.

Ranjan Gupta and M. L. Kurtadikar were the co-ordinators of this workshop.



## IUCAA Preprints

Listed below are the IUCAA preprints released during October - December 2011. These can be obtained from the IUCAA library (library@iucaa.ernet.in). The preprints can also be freely downloaded from <http://www.iucaa.ernet.in/~library/main.html>.

Zoltan Batiz and Bhag C. Chauhan, *Green's function formalism of holography with arbitrary mass, spin, and dimensionality*, IUCAA-23/2011; Jayanti Prasad, and Jayaram Chengalur, *FLAGCAL: A flagging and calibration package for radio interferometric data*, IUCAA-24/2011.



## Workshop on Stellar Astrophysics



A workshop on Stellar Astrophysics was organized by Department of Physics, University of Kashmir, during October 24 – 26, 2011. The workshop was sponsored by IUCAA. More than 60 participants from Kashmir, and seven outstation participants from Udaipur, Allahabad and Mumbai attended actively in this workshop. On this occasion, the Vice-Chancellor of the University of Kashmir presided over the inaugural function, and Ajit Kembhavi, Director, IUCAA, was the Chief Guest. The Chairman of the Department of Physics, Sheikh Javid Ahmad, gave

the welcome address, and the Registrar and the Dean of Academic Affairs, University of Kashmir, also spoke on this occasion. The inaugural function was attended by a good number of faculty members and the students of various departments of the university.

As a part of the workshop, Ajit Kembhavi gave a public talk on “Extra solar planets: Worlds beyond the solar system”. About 250 participants from various neighbouring institutes attended this talk. This was followed by an question and answer session.

Speakers in the workshop included Ajit Kembhavi, Ranjan Gupta, Ranjeev Misra, Swara Ravindranath (all from IUCAA), and Manzoor Malik (Kashmir University). There were lectures on various topics: stars in the galaxy, stellar spectroscopy, circumstellar dust, and new telescopes, compact objects, neutron stars and blackholes, radiative processes for compact objects, basics of star formation, evolution of low mass and high mass stars, statistical mechanics and galaxy clustering. Besides these talks, two lab sessions were also organized by Ranjeev Misra. The Research scholars namely, Tabasum, Bari, Gowhar and Naveel assisted during the lab sessions.

The Vice-Chancellor thanked IUCAA for supporting this workshop, and hoped that such joint events would also be organized in the future. Naseer Iqbal from the Department of Physics, University of Kashmir, and Ranjeev Misra from IUCAA, were the coordinators of this workshop.



## EGO-IndIGO Meet on Gravitational Waves

The European Gravitational Observatory (EGO) in collaboration with IndIGO, the Indian Initiative in Gravitational-wave Observations organized a joint workshop on gravitational waves. The meeting was held at IUCAA during November 1-2, 2011. The meeting was jointly supported by the Embassy of Italy in New Delhi and IUCAA.

EGO is a Consortium of funding agencies, whose main responsibility is the commissioning of Advanced Virgo in 2015, and the goal, to detect a gravitational waves through the Virgo-LIGO network. The workshop included excellent talks by EGO researchers on the different aspects of science and technology used in advanced Virgo and also the path to the future third generation GW observatory called the Einstein project. Indian experimenters working with allied technology

discussed their work and discussed possible overlap of their expertise with GW experimentation. There were very lively discussions, and EGO researchers were forthcoming with suggestions and support for the LIGO-India proposal.

EGO expressed strong interest in establishing avenues of bilateral scientific collaboration between EGO and IndIGO, and launch a wider cooperation to work subsequently towards a suitable MoU between the two Consortia in the future. The scientific organization was coordinated by Federico Ferrini (EGO) and Bala Iyer and Tarun Souradeep (IndIGO). The local organization was by Tarun Souradeep and Lidia Szpyrkowicz (Scientific Attache, Italian Embassy, New Delhi).





## International Conference on Interstellar Dust, Molecules and Chemistry



An International Conference on *Interstellar Dust, Molecules and Chemistry* was held at IUCAA during November 22 – 25, 2011. The interstellar medium is a treasure trove for the study of a variety of physical phenomenon, and recent advances in observational, laboratory and theoretical studies have opened up several avenues for diverse interdisciplinary research. The conference was aimed at providing a platform for expert discussions and presentations with ample opportunities for the young researchers to interact and take up challenging problems in this field.

The conference was attended by 61 participants, including 15 from abroad. The foreign participants were from Canada, USA, UK, France, Germany, Spain, Russia, China, and Japan. Apart from scientists from research institutes, there was a large representation of researchers from Indian universities. The sessions consisted of 18 reviews, 20 contributory talks and 20 poster presentations. The topics discussed ranged from infrared observations of star formation, dust extinction, PAH features, theoretical modelling, laboratory simulations, and astrochemistry. In view of the far-IR observations becoming available from Herschel and those possible from the James Webb Space Telescope, the future of research in these fields is bright.

The conference was coordinated by Shantanu Rastogi from D.D.U. Gorakhpur University, and Ranjan Gupta. The presentations are available at [www.iucaa.ernet.in/~idmc](http://www.iucaa.ernet.in/~idmc)





# Workshop on Galaxies: Normal and Active

IUCAA sponsored Workshop on *Galaxies: Normal and Active* was held at the School of Physical Sciences of SRTM University, Nanded, during November 14-17, 2011.



Scientific rationale of the workshop was to give exposure to the participants regarding frontline research areas in extragalactic astronomy and also to give training on analysis of data. There were about 100 registered participants, including 40 outstation participants consisting of research scholars, teachers, and M.Sc. students.

The workshop was inaugurated by S. B. Nimse, Vice-Chancellor of SRTM University, Nanded, and Ajit Kembhavi, Director, IUCAA, in the presence of Dilip Ukey, Pro Vice-Chancellor of SRTM University. R. S. Khairnar, Director, School of Physical Sciences, gave a brief overview of the department's academic activities. In the inaugural remarks, Ajit Kembhavi admired the resources available at SRTM University and their importance for imparting training in future programmes to be undertaken in association with IUCAA.

There were a series of lectures during the morning sessions covering topics, introduction to galaxies, classification of galaxies, active galactic nuclei and active galaxies, radiation from compact objects, introduction to X-ray astronomy, X-ray emission from AGN, radiations from groups and clusters of galaxies, optical and UV emission from AGN, ISM in galaxies. Resource persons were Ajit Kembhavi, Gulab C. Dewangan, Ranjeev Misra, Joydeep Bagchi, R. Srianand (all from IUCAA,) and M. K. Patil from SRTM University. In addition to two technical talks, Ajit Kembhavi also delivered a popular evening talk on *Kepler to Kepler: Journey over 400 years*. This popular talk was attended by a wide range of audience, comprising about 1000 school/college students, teachers and science loving citizens, following which, there was a very long question and answer session.

In addition to the technical lectures in morning sessions, there were hands-on training session on X-ray data analysis from XMM-Newton space mission. During these session, each participant got rigorous training on the installation of software, downloading, filtering and calibrating X-ray data, and deriving scientific results from the analysis. Local research scholars: Nilkanth Vagshette, Mahadev Pandge, Swati Deshmukh, Satish Sonkamble, and Pramod Pawar, assisted during the data analysis sessions.

The workshop concluded with the presentations, where 12 participants gave presentations about their present work. Finally, in the feedback session, participants requested organizers for hosting frequent and more focused workshops in future. Faculty members : R. S. Mane, A. C. Kumbharkhane, Mahabole, A. S. Chaudhari, and A. V. Sarode were fully involved in the successful organization of this workshop. The coordinators for this workshop were M. K. Patil and Gulab C. Dewangan.

## Seminars

Listed below are the seminars given at IUCAA during October - December 2011.

11.10.2011 Arunima Banerjee on *Vertical structure of disk galaxies and their dark matter halos*; 18.11.2011 Ashok Ambastha on *Sounding the Sun's interior and sub-surface weather of solar active regions*; 23.11.2011 Changbom Park on *Environmental connection of galaxy properties*; 28.11.2011 Sharanya Sur on *Magnetic fields during the formation of the first stars*; 30.11.2011 Manjari Bagchi on *Millisecond pulsars in galactic globular clusters*; 02.12.2011 Anupreeta More on *Investigating the group-scale lenses with the SL2S-arcs sample*; 03.12.2011 Surhud More on *The overdensity and masses of FOF halos and the universality of the mass function*; 23.12.2011 Sudipta Sarkar on *Black hole thermodynamics beyond general relativity*; 26.12.2011 Sukanya Chakrabarti on *A new probe of the distribution of dark matter in galaxies*; and 26.12.2011 Manu Paranjape on *A simple proposal for measuring the speed of propagation of gravitational phenomena*.

## Colloquium

12.12.2011 John Ellis on *The large Hadron Collider and cosmology*.

## ICTS School on Cosmology and Gravitational Waves



An international school of the International Centre for Theoretical Sciences (ICTS), titled "School on Cosmology and Gravitational Waves", as part of its Frontiers of Cosmology and Gravitation programme, was held at IUCAA during December 1-11, 2011. The main aim of the school was to bring internationally renowned experts to give lectures to students, interested in frontline research areas in cosmology and gravitational waves.

There were sixty participants, with about twenty foreign participants including

lecturers. The school consisted of about forty lectures and nine contributed talks by students, distributed over ten lecture days. There were ten international lecturers who are young achievers in their respective areas. The lecturers introduced the students to the basic concepts of early universe cosmology, cosmic microwave background (CMB), structure formation and gravitational waves (GW) and more importantly, covered the current frontiers of advanced research areas like non-Gaussianity of CMB anisotropy, baryon acoustic oscillations, CMB polarization anisotropy measurement, and detection strategies of gravitational waves using big laser interferometers.

The outcome of the school was impressive. Participants not only enjoyed the lectures, they were also keen on presenting their research in the limited number of contributed talks allotted to them. They maintained a very high standard in their talks and received ample appreciation from other participants. Students also had long discussions with the lecturers about the course material and their own specific research topics, which sometimes continued for a long time after dinner!

The next few years are going to be crucial for observational cosmology and gravitational waves research, e.g., the Planck mission will produce its cosmological measurements at unprecedented accuracy, advanced LIGO detectors promise first direct detection of gravitational waves. A school of this kind was, therefore, very timely, and participants appreciated that wholeheartedly.

The organizers of the meeting were Subhabrata Majumdar (TIFR), Sanjit Mitra and Tarun Souradeep from IUCAA.



### *Welcome to...*

**Balaji Dodda**, who has joined as a research scholar.

**Sanjit Mitra**, who has joined as a faculty member, Scientist E (Assistant Professor). His areas of research are Gravitational Waves, Cosmology and Cosmic Microwave Background.

### *... Farewell to*

**Ruta Kale**, who has joined as a Post-doctoral fellow at the Instituto di Radioastronomia (IRA) and the University of Bologna (jointly), Italy.



## IUCAA-NCRA Radio Astronomy Winter School



The 4th Radio Astronomy Winter School for College and University Students was conducted by the IUCAA-NCRA Radio Physics Laboratory (RPL), a joint facility of IUCAA and the National Centre for Radio Astrophysics (NCRA), during December 26, 2011 - January 2, 2012, at the IUCAA and NCRA/TIFR Pune campuses. The winter school was attended by about 30 graduate and undergraduate students of science and engineering. Following the goals envisaged for the Radio Physics Laboratory, a major emphasis was on a practical hands-on approach for teaching radio astronomy. For understanding the practical/instrumental aspects of radio astronomy, the students conducted real-time astronomical observations of Sun and 21-cm spectral line of neutral Hydrogen gas in our Milky-Way using a radio telescope of 3m diameter, located at the NCRA east campus. There was also a "Small Affordable Radio Telescope (SART)" making session, in which the participants were given all the parts for assembling a small yet fully functional radio telescope using a commercial DTH dish antenna and readily available components. They also performed Antenna and Wave Propagation experiments in IUCAA's Radio Physics Laboratory, which allowed students to understand the characteristics and importance of various types of antennae used in radio astronomy and communication. In parallel with these experiments, the students were also introduced to various important branches of Astronomy and Astrophysics through a series of lectures delivered by faculty members from IUCAA, and NCRA/TIFR. The subject matter ranged from Radio Telescopes, Astronomical Coordinate Systems, Early Radio Astronomy, the Sun, Milky-way, Pulsars, Dark-matter, Radio Galaxies - to Quasars, Cosmic Microwave Radiation, Galaxy Clusters, Cosmology and Big-bang Theory. During the winter school, the participants visited the sites of Giant Metrewave Radio Telescope (GMRT), operated by NCRA/TIFR and IUCAA's 2 m optical telescope facility at the Girawali Observatory near Pune. The programme exposed the young students to working of these instruments and excitement of doing astronomy with large telescopes. Throughout the school, the students showed tremendous enthusiasm and curiosity for learning new subjects, and they freely interacted among themselves and with faculty members. Moreover, they prepared and presented their own informative posters on various interesting topics in Physics and Astronomy. The best teams received handsome prizes. The School was coordinated by Joydeep Bagchi (IUCAA) and Bhal Chandra Joshi (NCRA/TIFR).

### 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) (email: aocp@iucaa.ernet.in), IUCAA, by March 31, 2012 (for events to be conducted during August 2012 - July 2013), 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, (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 members 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.

## Visitors Expected (January 2012)

P.C. Agrawal, IUCAA, Pune; C.S. Aulakh, Panjab University, Chandigarh; Jai Bhagwan, ARIES, Nainital; Asis Chattopadhyay, Calcutta University, Kolkata; Goutami Chattopadhyay, Institute of Radiophysics and Electronics, Kolkata; Surajit Chattopadhyay, Pailan College of Management and Technology, Kolkata; Tanuka Chattopadhyay, Calcutta University, Kolkata; Ashok Das, University of Rochester, USA; Rinku Dutta, Tata Trust, Mumbai; Nayere Erfanian, Sistan University, Iran; Poshak Gandhi, ISAS, Japan; Rahul Ghosh, Bhairab Ganguly College, Kolkata; Alok Gupta, ARIES, Nainital; Manowar Sk. Hossein, Aliah University, Kolkata; Bhola Ishwar, B.R.A. Bihar University, Muzaffarpur; Jithesh V., University of Calicut, Kerala; Dhanya Joseph, University of Calicut, Kerala; Md. Mehedi Kalam, Aliah University, Kolkata; Michael Little, Idea Design, Bangalore; Soma Mandal, Taki Government College, West Bengal; Bari Maqbool, University of Kashmir, Srinagar; Tabasum Masood, University of Kashmir, Srinagar; Smita Mathur, Ohio State University, USA; Biley Menon, Landscape Architect, Bangalore; M. Nikesh, University of Calicut, Kerala; Pramod Pawar, Swami Ramanand Teerth Marathwada University, Nanded; Kedar Phadke, IISST, Trivandrum; Sajeeth Ninan Philip, St. Thomas College, Kerala; A.U. Preetha, University of Calicut, Kerala; Alam Shah, Jamia Millia Islamia, Delhi; Marsha Shams, IISST, Trivandrum; Firoza Sutaria, Indian Institute of Astrophysics, Bangalore; Michael Thompson, National Center for Atmospheric Research, USA; Steve Tomczyk, National Center for Atmospheric Research, USA; C.V. Vishveshwara, Jawaharlal Nehru Planetarium, Bangalore; and M. Vivek, Cochin University of Science and Technology, Kochi.

## February 2012

Hassan Amirhashchi, Mahshahr Islamic Azad University, Iran; Nigel Bishop, University of South Africa; Robert Botet, University of Paris, France; Chanchal Chawla, Sant Longowal Institute of Engineering and Technology, Sangrur; Sanjit Das, Indian Institute of Technology, Kharagpur; Kalyan Dutta, Lockheed Martin Missiles and Space Company, USA; Edith A. Hadamcik, University of Paris, France; Andrew Hillier, University of Kyoto, Japan; Brendon O'Dwyer, University of Cambridge, UK; Anirudh Pradhan, Hindu Post-Graduate College, Uttar Pradesh; Sonali Sachdeva, University of Delhi; Asoke Sen, Assam University, Silchar; D. Priya Shanti, Osmania University, Hyderabad; Sauro Succi, Institute of Applicazioni Calcolo, Italy; Pranjal Trivedi, Sri Venkateswara College, Delhi; and D. B. Vaidya, Ex-Gujarat College, Ahmedabad.

## March 2012

Subhash Kaushik, Government P.G. Excellence College, Madhya Pradesh; Balveer Singh, Jiwaji University, Gwalior; and Binod Srinivasan, Indian Institute of Technology, Kanpur.

## Long term visitor :

Pushpa Khare (till January 2014)

## Visitors (October-December 2011)

P.C. Agrawal, Rupali Ahire, G.C. Anupama, Abhay Ashtekar, Dharmanand Baboolal, Bijan Kumar Bagchi, Manjari Bagchi, Jasjeet Bagla, Tanwi Bandyopadhyay, Srikumar Banerjee, S.B. Bhatt, Gour Bhattacharya, Samarpita Bhattacharya, Sudip Bhattacharya, Sanjay Bhoite, K.G. Biju, Ritabrata Biswas, Prashina Budree, Russell Cannon, Marie-Noelle Celerier, Sukanya Chakrabarti, Shuvendu Chakraborty, Suresh Chandra, Saumyadip Chaudhury, Laxmikant Chaware, Rabin Chhetri, Sowgata Chowdhury, Pratik Dabhade, H.S. Das, Ujjal Debnath, Atul Deep, Broja Dutta, John Ellis, Govender Gabriel, Madhuri Gaikwad, Kim Gillies, Aruna Govada, Sarbari Guha, K.P. Harikrishnan, N.G. Ibohal, Joe Jacob, Agnieszka Janiuk, Sanjay Jhingan, Nidhi Joshi, Kanti Jotania, Anmay Kane, Nisha Katyal, Rizwan Shahid Khan, Avas Khugaev, Badri Krishnan, Shrinivas Kulkarni, Bhagwat Kumthekar, Sunil Maharaj, Azadeh Maleknejad, Soma Mandal, Sumit Mookerjee, Sneha More, Pradip Mukherjee, K.S.V.S. Narasimhan, Anand Narayanan, Archana Pai, S.K. Pandey, P.N. Pandita, Preeti Panjwani, Manu Paranjape, Changbom Park, Devraj Pawar, Ninan Sajeeth Philip, Nilesh Pokharkar, Suryakumari Rajah, S. Ramya, Chayan Ranjit, Shantanu Rastogi, Somak Raychaudhury, Prabir Rudra, Kailash Rustagi, B.S. Ratanpal, Krishna Reddy, Sanjay Kumar Sahay, Sunder B. Sahayanathan, Sheetal Kumar Sahu, Tarun Saini, Sudipta Sarkar, Tamal Sarkar, Asoke Kumar Sen, Anand Sengupta, Arman Shafieloo, Kiran Shanker, D. Priya Shanti, Akansha Sharma, Ranjan Sharma, Rathin Sharma, Sandeep Sharma, Soniya Sharma, Sneha Shashidhara, Ashmeet Singh, H.P. Singh, Subid K.S., Eric Tatulli, Kip Thorne, Ramesh Tikekar, Alexei Toporensky, Shruti Tripathi, Pranjal Trivedi, P. Udayashanker, A.A. Usmani, Hum Chand Varma, V. Vinu, and Andrzej Antoni Zdziarski.

About 300 participants visited IUCAA and attended the various meetings, workshops, schools and conferences.



## Public Outreach Activities



On December 26, 2011, IUCAA organised a public outreach programme for 120 students from the National Service Scheme (NSS). This was part of a camp held at Ghodegaon, which ended with a visit to the IUCAA Girawali Observatory (IGO). During the course of the visit, Samir Dhurde gave an introduction to astronomy and its importance to these students of varied educational backgrounds. Nilesch Pokharkar explained the working of the Observatory with a tour inside. The students also got to interact with Arvind Paranjpye, Director, (Planetarium), Nehru Science Centre, Mumbai, who talked about the early development of IGO and his role in it.

**National Children Science Congress:** On December 28, 2011, Durgesh Tripathi and Samir Dhurde from IUCAA participated in a Video Conferencing Activity for the National Children Science Congress, 2011 held in Jaipur. The programme had an audience of 200 students from all over the country. They gave a small presentation related to the Sun and its active phase via satellite link. They also answered many questions related to astronomy.

### Workshops on Astronomy for School Teachers and Science Educators

Two outreach workshops on Astronomy for School Teachers and Science Educators were conducted at IUCAA Resource Centre (IRC) CUSAT, Kochi and IRC, Udaipur in the month of November and December.

The workshop at Kochi was coordinated by V. C. Kuriakose during November 3 - 4, 2011 and the workshop at Udaipur was coordinated by S.N.A. Jaaffrey during December 1 - 3, 2011. Arvind Paranjpye from IUCAA conducted these workshops.

The aims of these workshops were to update the teachers and science educators about the latest information about the topics being taught in the classrooms, doing hands-on activities, and discuss and debate on the issues like debunking astrology.

Arvind Paranjpye gave a series of talks on The Solar System, Eclipses and Occultations with emphasis on the Transit of Venus on 6th June 2012 and Astronomical Spectroscopy. He also carried out hand-on activities like finding north-south directions using vertical gnomon, measuring the circumference of the earth and making of simple spectroscope with CD/DVD.

At the Kochi workshop, V. C. Kuriakose delivered lectures on astronomical topics in the local Malayalam language, and the students of Department of Physics carried out observations of the Sunspots, and participated in the discussion on debunking astrology.

The Udaipur workshop was inaugurated by I. V. Trivedi, Vice-Chancellor, Mohan Lal Sukhadia University, Udaipur and P. C. Agrawal, Chair Professor and Principal Director of ASTROSAT Mission, ISRO was the Chief Guest. He also delivered a lecture on 'Birth and Death of the stars'.

The participants visited Global Oscillation Network Group (GONG) and Udaipur Solar Observatory (USO), Udaipur. A. Ambastha gave a brief introduction on USO and GONG. P. Venkatakrishnan, Director, USO, delivered a lecture on 'The Sun'.

Each of these workshops was attended by about 35 people, including invited participants (teachers and science educators) and the local faculty members and students.

## Know Thy Clouds - 8

### Cirrostratus: The cloud that makes Halos

Arvind Paranjpye

Cirrostratus clouds get their name from composite of the Latin cirrus, meaning wisp or curl and stratus, meaning layer.

These clouds are thin and spread uniformly across the sky at altitude of about 5500 metres. The sun or the moon can be seen through these clouds. When these clouds are spread uniformly across the sky, they may be so thin that these are hardly visible to untrained eyes. The only indication of their presence is the halo round the sun or the moon, which is a result of refraction of light by the ice crystals in the clouds. Sometimes the halo also has a coloured ring. The sun or the moon halo has diameter of 44 degrees. The complete halo does look very attractive, but if the cloud is not well spread out then one might see only a part of it.

These clouds may be formed by merging of cirrus<sup>1</sup>, from ice crystals falling from cirrocumulus<sup>2</sup>, from the thinning of altostratus<sup>3</sup> (these clouds look similar to cirrostratus however, these do not form halos), or by spreading out the cirrus plumes from the anvil of cumulonimbus<sup>4</sup> clouds.

In general, cirrostratus do not produce precipitation (i.e., rain), and their thickness increases and reaches to the altitude of 10000 metres, indicating a large amount of moisture in the upper atmosphere. The presence of these clouds may indicate that beginning of a warm front and thus, forthcoming precipitation in next 8 to 24 hours. When the cloud thickens, the appearance of the sun too becomes dull.

1) Know Thy Clouds - 4, January 2011, Khagol No. 85

3) Know Thy Clouds - 5, April 2011, Khagol No. 86

2) Know Thy Clouds - 7, October 2011, Khagol No. 88

4) Know Thy Clouds - 3, October 2010, Khagol No. 84



Name	Cirrostratus
Symbol	Cs
Height	5,000 m - 10,000 m
Symbol	



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We welcome your responses at the following address:  
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