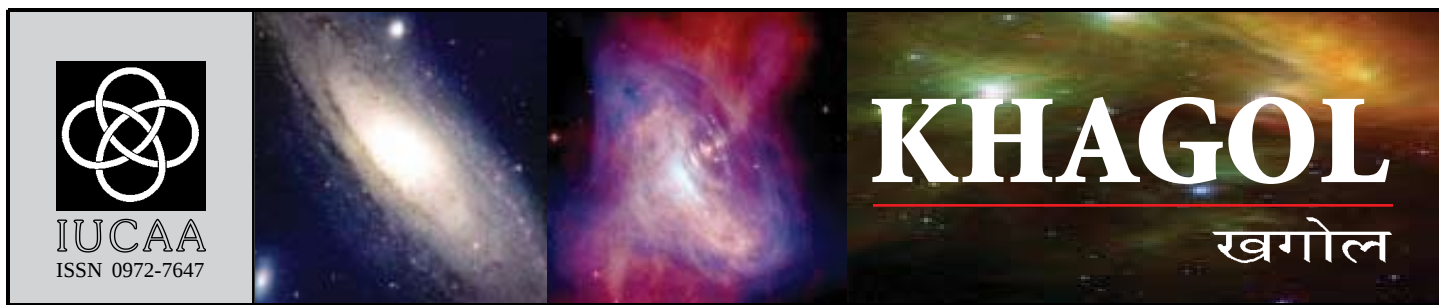




A Quarterly Bulletin of the Inter-University Centre for Astronomy and Astrophysics
(An Autonomous Institution of the University Grants Commission)

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Dr. K. Kasturirangan delivering the Foundation Day Lecture

The 19th IUCAA Foundation Day lecture was delivered by Dr. K. Kasturirangan, Rajya Sabha MP and former chief of the Indian Space Research Organisation. He chose the timely theme of ASTROSAT, an Indian satellite dedicated to Astronomy, that is being readied for launch by ISRO in 2009. After recalling the beginnings of space-based astronomy in India, Dr. Kasturirangan put in perspective the origin of the ASTROSAT concept and described its configuration, capabilities and science plan.

He pointed out that over a four-year planning period starting in 1996, widespread discussions were held to arrive at the ASTROSAT configuration, which would offer an unprecedented range of spectral coverage through a mix of well-proven and new technologies. While this will provide

an unique opportunity to pursue science that requires simultaneous multi-wavelength coverage combined with high time resolution, the wide spectral capability will also cater to the diverse interests of the versatile astronomy community in India. After a comprehensive summary of the work being done in a large number of institutions to realise the satellite hardware, he pointed out a number of areas where new collaborators can get involved -- such as instrument calibration, data interpretation including theoretical modelling and complementary observations using other telescopes. He concluded by strongly urging IUCAA to play a major role in enlarging the ASTROSAT user community.

Congratulations to...

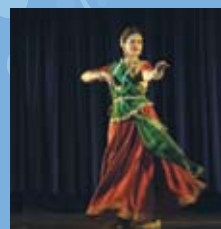
Arvind Gupta, on being conferred with the *Harmony Silver Award (2007)* presented by Harmony (A Dhirubhai Ambani Memorial Trust Initiative, Mumbai) and *Indira Gandhi Prize for Popularization of Science (2008)* by Indian National Science Academy, New Delhi.

Ajit K. Kembhavi, on being elected a *Fellow of National Academy of Sciences*, India.

Tarun Souradeep on being conferred with the *B.M. Birla Science Prize in Physics (2006)* by B.M. Birla Science Centre, Hyderabad.

R. Srianand, on being elected a *Fellow of Indian Academy of Sciences*, India.

Glimpses of ICGC 2007



The sixth International Conference on Gravitation and Cosmology, ICGC-2007, was organized and hosted by IUCAA during December 17 - 21, 2007. This series of international meetings, held every four years under the auspices of the Indian Association for General Relativity and Gravitation (IAGRG), has now spanned two decades. Previous ICGC meetings were held at Cochin University of Science and Technology (2004), Indian Institute of Technology, Kharagpur (2000), IUCAA, Pune (1995), Physical Research Laboratory, Ahmedabad (1991) and Goa (1987). The meeting brought together active scientists from all over the globe to present the state-of-the-art at the frontiers of Gravitation and Cosmology and promising future directions. It also offered younger Indian researchers an opportunity to interact with experts from within India and abroad. The meeting was attended by about 160 participants selected from around 285 requests for registration.

The scientific programme, put together by the SOC chaired by G. Date, IIMSc., Chennai, had 19 plenary talks on current theoretical, observational and experimental topics in cosmology, general relativity, detection of gravitational waves, and various approaches of quantum gravity. The meeting also included four parallel intensive workshops focused on cosmology, classical general relativity and gravitational waves and quantum gravity. The workshops had around 75 oral presentations. The immensely rich and diverse scientific programme was aptly summarized by Juergen Ehlers at the end. A public lecture on 'Oldest light in the Universe' by NASA scientist, Gary Hinshaw, who is a

member of the WMAP team (formerly, also a member of the COBE-DMR team that won the Nobel prize in 2006) was also organized as part of ICGC-2007 and drew sizable audience from the public in Pune. The cultural evening of splendid Indian classical dance by famous Kathak dancer, Shambhavi Vaze, whose troupe presented a blend of classical and contemporary items was a highlight and so was 'deepavali' candlelight display of the IUCAA kund by our graduate students.

The meeting was financially supported by generous contributions from Indian organizations: ISRO, CSIR, DST, BNRS, and IAGRG; and from Indian institutes: HRI (Allahabad), IIA (Bangalore), IIMSc (Chennai), RRI (Bangalore), SINP (Kolkata), and IUCAA. The conference banquet was sponsored by Hewlett-Packard and the reception dinner was sponsored by the Bank of Baroda. The local organization was chaired by Tarun Souradeep, who was ably supported in this task by a very dedicated LOC team. They enjoyed full support and extensive help from many other members of the entire IUCAA 'family'.

Details of the meeting, including the electronic version of the talks may be accessed online at the conference webpage <http://www.iucaa.ernet.in/~icgc07>

The proceedings of ICGC-2007 will be published soon in the Journal of Physics: Conference Series (JPCS) of IOP publishers.

Conference on Measuring Spin and Mass of Black Holes



Presentation on ASTROSAT by Madhavan Nair (top) and the participants of the Conference

Over the last two decades, there has been mounting evidence for the existence of black holes. It is now believed that nearly all galaxies harbour super-massive black holes and that some galactic X-ray binary systems are powered by the accretion of matter onto black holes, which are formed by the collapse of massive stars. These systems are expected to serve as laboratories to study the behaviour of matter in extreme conditions and to test the general theory of relativity in the strong field limit. The study of the growth of super-massive black holes over cosmological times will shed light on the creation and subsequent evolution of galaxies. A fundamental challenge in the field is to find reliable techniques to measure the mass and spin of black holes and their implementation, which was the main agenda for this conference, which was held during December 18 - 20, 2007. The meeting was attended by the leading experts in the field from India and abroad including, A. Fabian (IOA, UK), R. Narayan (Harvard University, U.S.A), J. McClintock (Harvard University), H. Netzer (Tel-Aviv University of Israel), P. Charles (SAO, South Africa), P. Ghosh (TIFR), A. R. Rao (TIFR), and D. J. Saikia (NCRA).

High quality spectral information and variability measurements of these black hole systems, especially in X-

rays, UV and optical wavebands, will be crucial to further advancement of this field. The instruments on board the Indian satellite ASTROSAT, scheduled to be launched in 2009, would provide unprecedented multi-wavelength coverage of black hole systems and indeed observation of AGN and X-ray binaries are part of several ASTROSAT key projects. To increase the awareness of ASTROSAT and other related ISRO missions, especially among the international participants, a special evening session was organised on December 19: Madhavan Nair, Chairman, ISRO, started the session by describing ISRO's space capabilities and commitment to astronomical research. P. C. Agrawal (TIFR), and D. Bhattacharya (IUCAA) presented the descriptions of the instruments that will be on board of ASTROSAT and the science that is expected to be achieved. Ed van den Heuvel (University of Amsterdam, The Netherlands) highlighted the unique opportunities to do front line science that will be opened up by ASTROSAT.

The meeting was coordinated by R. Misra, A. K. Kembhavi, and D. Bhattacharya, and was supported by IUCAA, ISRO and DST.

International Year of Astronomy – 2009

The United Nations has declared 2009 as the International Year of Astronomy (IYA) and all the countries in the world are planning different activities during this year. IAU has designated Ranjeev Misra of IUCAA as the Single-point of-contact (SPOC) for IYA09-India activities. A website related to this has been set up at url <http://www.iucaa.ernet.in/~iya09ind/>

The INSA has constituted an INSA-IAU committee under the chairmanship of T. Padmanabhan, IUCAA which, among other tasks will also coordinate national level activities of International year of Astronomy, 2009. The INSA-IAU has a webpage at url http://www.hri.res.in/~jasjeet/insa_iau/insa_iau.html.

Comments and suggestions regarding different activities related to IYA09 are most welcome.

Workshop on Astronomy with Virtual Observatories

The workshop on Astronomy with Virtual Observatories, was conducted at IUCAA during October 15-19, 2007. It was organized by the Virtual Observatory India (VO-I) project, which is based at IUCAA and is a collaborative effort between IUCAA and Persistent Systems Pvt. Ltd. (PSPL), Pune. The aim of the workshop was to introduce the faculty and research students interested in astronomy and related areas to VO concepts, to recent technical developments in the field and the use of VO tools in astronomy.

Experts in the area from various VO projects in Europe, the USA, and India were invited to give lectures, conduct demonstrations and hands-on-sessions. Participants came from different institutions, university departments and colleges in India, as well as from other countries.

The workshop started with an overview of VO by Paolo Padovani of Euro-VO and a review of data archives and methods of access by Ajit Kembhavi, IUCAA. These reviews were followed by a number of talks over the next five days which covered specific technical aspects, science drivers, VO tools and specific applications to science cases, like the discovery of quasars and the initial mass function of massive stars. The demonstrations by experts provided introduction

to important archives like SIMBAD, VIZIER, and tools like ALLADIN, VOPlot, etc. The demonstrations also covered SQL and data retrieval from the Sloan Digital Sky Survey. The demonstrations were followed by hands-on-sessions conducted in a sophisticated computer laboratory, which has been developed at IUCAA for the purpose. These sessions allowed participants to familiarize themselves with intricacies of the complex software with the help of people, who in many cases had actually developed the software themselves. The response of the lectures as well as practical sessions was excellent and many mature as well as young astronomers were enthusiastic participants.

The VO concept and tools have been developed over the last several years and are being adopted by the international astronomical community. The workshop at IUCAA has gone a long way in forging a link between the communities of developers and users. It was in fact the first workshop of its kind anywhere to combine technology and science in a very successful manner.

The workshop was funded by IUCAA, PSPL, DST, ISRO and the Ministry of Communication and Information Technology.



The sessions and participants

Indo-Brazil Workshop on Cosmology

The first Indo-Brazilian workshop on Cosmology was held during July 16-21, 2007. The aim of the workshop was to bring together several Indian and Brazilian cosmologists for discussions and interactions. Participants of the workshop were drawn from various research institutes and universities in India with six scientists from Brazil (Raul Abramo, Carlos Alexandre Wuensche, Ioav Waga, Saulo Carneiro, Jose Ademir Lima and Jailson Alcaniz). The format of the workshop consisted of 22 one hour talks, spread over six days, with extensive discussions during and after the talks. Mainly, topics related to early universe and cosmology were covered. Overall, the workshop resulted in closer contacts being established between many of the participants.



Participants of the Indo-Brazil Workshop

Jailson Alcaniz of Observatorio Nacional, Rio de Janeiro, Brazil, and T. Padmanabhan of IUCAA jointly coordinated the workshop.

Workshop on Observations with Small Telescopes

This workshop was held at the Department of Physics, Bhavnagar University during November 19-21, 2007 and was attended by 29 participants comprising of college and university teachers, researchers, M.Sc. and B.Sc. students, and amateur astronomers from various corners of the country. There were 9 lecture sessions and 2 night observing sessions on the Bhavnagar Telescope.

On the first day, J.N. Desai (Ex-PRL) talked on the observations of cometary ion tails and various related studies using a small telescope and gave an informal evening talk later. A talk on astronomical detectors was delivered by Vijay Mohan (IUCAA). Fine details of astronomical imaging through PSF and error in CCD data were presented in a very illustrative way by S. N. Tandon (IUCAA). The second day began with S. D. Verma (Ex-Gujarat University) talking on the history and importance of gamma ray bursts and followed by a talk by S. P. Bhatnagar (Bhavnagar University). In his second talk, Vijay Mohan presented the nuances of photometry in quite effective way. A very informative talk by N. M. Ashok (PRL) on eruptive variables brought out the possibility of observations using small telescopes. Ranjan Gupta (IUCAA) showed another possible application of small telescopes in spectroscopy. R. V. Upadhyay, Head of the Department, (Bhavnagar University) gave a brief review of the development of the department activities.



Participants of the Workshop on Observations with Small Telescopes

On the last day, T. Chandrasekhar (PRL) gave a talk on measuring the sizes of stars. The last talk of the workshop was on dust properties using extinction and polarization by D. B. Vaidya (Ex-Gujarat College).

Overall, the workshop was very useful and interesting to the students, who want to have astronomy as their career.

S. P. Bhatnagar was the local coordinator of the workshop. S. K. Pandey of Pt. Ravishankar Shukla University, Raipur, and Vijay Mohan were the coordinators from IUCAA.

Eratosthenes Experiment

On December 22, 2007, the day of winter solstice (for northern hemisphere), an observing experiment to measure latitude and longitude of a place was carried using EDUSAT. The experiment was based on Eratosthenes experiment carried out about 2000 years ago.

Ten stations from different parts of India participated in this programme. Prior to the day of the observations, detailed notes on conducting the experiments were circulated to all the stations and two separate interactive sessions were conducted via EDUSAT to explain the project on doing the experiment, and to clarify the doubts of the participants.

The programme was proposed by Arvind Paranjpye and was coordinated on line on EDUSAT by Arvind Ranade of Vigyan Prasar in Delhi and Samir Dhurde at IUCAA, Pune.

Seminars

4.10.2007 Prateek Sharma on *Transport and heating in low luminosity accretion flows*; 26.11.2007 T. Sivarani on *Probing the nature of first stars with observed abundance patterns of empirical stars*; 6.12.2007 Sergey Chervon on *Non-linear fields in general relativity and cosmology*; 7.12.2007 Ishwaree Neupane on *Inflation and dark energy: some lessons from string theory (or vice versa)*; 10.12.2007 Manu Paranjape on *A modest appeal to conformal gravity*; and 26.12.2007 Sandeep Kumar on *Approximation to the CMB angular power spectrum*.

Colloquia

12.10.2007 Peter Gillingham on *The attractions of antarctic astronomy*; 16.10.2007 George Djorgovski on *Virtual astronomy and computationally enabled science for the 21st century*; 19.11.2007 Arnab Bhattacharya on *N-lightenment*; and 3.12.2007 Praveen Chaddah on *Phase transitions using magnetic fields, and the physics of glass*.

PuLastya Week

Muktangan Vidnyan Shodhika, the Science Centre of IUCAA, celebrated a Science Festival during November 11 - 14, 2007. This was to commemorate the birth anniversary of late Shri Pu.La. Deshpande, which fell on November 8. Fondly called "PuLa", Shri Deshpande was one of the visionaries behind the IUCAA Science Centre. The centre building is named "Pulastya" after him.

The first event, on November 11, was a Poster Competition on the "Sun-Earth Relationship". This was planned as a part of IUCAA's participation in the International Heliophysical Year. The participants were science-minded high school students. A brief lecture on the topic "Sun and Us" was given by Samir Dhurde. The ideas gathered by the kids from it were very adeptly put onto paper. The posters were displayed on the rest of the days. Three posters were chosen as winners. They are:

1. Maitreyi Gogate of St. Mary's Girls' School
2. Madhu Kumari of Army School, Kirkee
3. Kaushik Raychaudhuri of St. Ursula High School

On the next three days there were interactions with 51 schools, and about 1500 students and teachers from various schools have participated. Three full-day sessions allowed the MVS team to do science experiment demonstrations, screening of scientific films, Stellarium shows and science-based question-answer sessions. The response was good with full houses on all days. The Science Centre was kept open to all teachers and students so as to make them familiar with its working and the programmes they can attend here. The students also had fun with the exhibits in the science park and the new exhibition of medicinal plants. The programme ended on the Children's Day, November 14.

Preprints

Listed below are the IUCAA preprints released during October to December 2007. These can be obtained from the IUCAA Library (library@iucaa.ernet.in).

Tapan Naskar, Nabajit Chakravarty, Jayanta K. Bhattacharjee, and Arnab K. Ray, *Acoustic perturbations on steady spherical accretion in Schwarzschild geometry*, IUCAA-37/2007; Gargi Shawl, G. J. Ferland, R. Srianand, N. P. Abel, P.A.M. van Hoof, and P. C. Stancil, *On the enhanced cosmic-ray ionization rate in the diffuse cloud towards Zeta Persei*, IUCAA-38/2007; Sanjeev Dhurandhar, Badri Krishnan, Himan Mukhopadhyay, and John T. Whelan, *The cross-correlation search for periodic gravitational waves*, IUCAA-39/2007; Minu Joy, Varun Sahni and Alexei A. Starobinsky, *A new universal local feature in the inflationary perturbation spectrum*, IUCAA-40/2007; Hideki Maeda, Varun Sahni, and Yuri Shtanov, *Braneworld dynamics in Einstein Gauss Bonner gravity*, IUCAA-41/2007; Yuri Shtanov, Alexander Viznyuk, and Varun Sahni, *Gravitational instability on the brane: the role of boundary conditions*, IUCAA-42/2007; Archana Bora, Ranjan Gupta, Harinder P. Singh, Jayant Murthy, and Rekesh Mohan, *A 3D automated classification scheme for the TAUVE data pipeline*, IUCAA-43/2007; M. Jamrozy, C. Konar, J. Machalski, and D. J. Saikia, *A multifrequency study of giant radio sources II: Spectral ageing analysis of the lobes of selected sources*, IUCAA-44/2007; C. Konar, M. Jamrozy, D. J. Saikia, and J. Machalski, *A multifrequency study of giant radio sources I: Low-frequency Gaint Metrewave Radio Telescope observations of selected sources*, IUCAA-45/2007; and Patrick Petitjean, Cedric Ledoux, and R. Srianand, *The nitrogen and oxygen abundances in the neutral gas at high redshift*, IUCAA-46/2007.

Welcome to ...

Siddharth S. Malu, who has joined as a Post-doctoral Fellow. His areas of research are Systematic Effects in CMB Data Analysis, New Techniques in CMB Data Analysis for Interferometry, and Beam Combination in Interferometry.

... Farewell to

Supratik Pal, who has joined the Indian Statistical Institute, Kolkata, with the Platinum Jubilee Fellowshipship.

Visitors expected (January–March 2008)

January

Raj Bai, University of Rajasthan; Prashant Baghel, A.P.S. University, Rewa; P.C. Agrawal, TIFR, Mumbai; B. Paul, RRI, Bangalore; Manchanda, TIFR, Mumbai; Sukanta Bose, Washington State University, USA; S.K. Pandey, Pt. Ravishankar Shukla University, Raipur; C.D. Ravikumar, University of Calicut, Kozhikode; M.K. Patil, SRTMU, Nanded; N.S. Philip, St. Thomas College, Kozhencherry; N.D. Vagshette, SRTMU, Nanded; Naresh Chandnani, University of Rajasthan; L. Chaware, Pt. Ravishankar Shukla University, Raipur; Shrirang Deshingkar, HRI, Allahabad; K.P. Harikrishnan, The Cochin College; T. Hioko, Institute of Statistical Mathematics, Tokyo; Y. Itoh, Institute of Statistical Mathematics, Tokyo; Pramila Kumawat, University of Rajasthan; Y. Oasa, Institute of Statistical Mathematics, Tokyo; Y. Okada, Kobe University, Japan; Surajit Paul, Wuerzburg University, Germany; Bryan Penprase, Pomona College, USA; Sidharth Prabhu, IIT, Kharagpur; Rajeswaran, American College, Madurai; J.P. Singh, A.P.S. University, Rewa; A. Starobinsky, Landau Institute for Theoretical Physics, Russia; Shruti Tripathi, D.D.U. Gorakhpur University; Paniveni Udaya Shankar, Sri Bhagwan Mahaveer Jain College of Engineering, Karnataka; and V. Vinu, M.G. University, Kottayam.

February

R. Cannon, Anglo Australian Observatory; Chandan Ghosh, St. Xavier's College, Kolkata; N. Kanda, Osaka City University, Japan; Anoop Srivastava, D.D.U. Gorakhpur University; D.S. Srivastava, D.D.U. Gorakhpur University; Shweta Srivastava, D.D.U. Gorakhpur University; Ibrahim Selim, NRIAG, Egypt; H. Tagoshi, Osaka City University, Japan; and Oleg Zaslavski, Ukraine.

Visitors (October–December 2007)

Peter Gillingham, Anju Maurya, Prabhunath Prasad, S. Rastogi, Prateek Sharma, J. Arora, S. Chauhan, Rajesh Nayak, A. Mahabal, N. Kameswara Rao, P. Sreekumar, H. Tian, A. Paranjape, Jishnu Dey, Mira Dey, T. Chandrasekhar, A.A. Usmani, T. Kundu, R. Enea, A. Saha, Pradip Mukherjee, T. Gangopadhyay, Tanuka Chattopadhyay, K. Sriram, K. Jotania, Kuntal Mishra, R. Tikekar, N.S. Wadnerkar, D. Pawar, U. Dodia, S. Chatterjee, S. Chervon, Sivarani Tirupathi, A. Bhattacharya, V. Girish, Vivek Agrawal, S. Mitra, G. Dutta, M.C. Gupta, Satej Khedekar, S. Majumdar, Ishwaree Neupane, T.P. Prabhu, Santanu Das, Atish Kamble, Gareth Amery, A. Pradhan, Anand Sengupta, Sanjit Mitra, Zak Yacoob, M. Vivek, Mayank Kedia, S. Otarod, A. Arzhang, A. Avazpour, U. Narain, Joginder Sharma, Nishant Mittal, Sidharth Prabhu, Rabin Chhetri, K. Kasturirangan.

In addition, there were about 260 participants of various workshops and conferences.

For a dilute gas of oxygen, it is seen that the coefficient of viscosity η is independent of pressure, and varies with the temperature as $\eta \propto T^{0.73}$. Assume that the effective force of interaction between the molecules varies with the distance r as $F = \lambda/r^n$. Estimate the value of n .

Solution to For the Younger Minds - 22

To get rid of inessential factors, let us take the ambient temperature as the zero value in the temperature scale and also use units in which all specific heats are unity. Then Newton's law of cooling tells us that $T(t) = T(0) \exp[-kt/m]$, where $T(t)$ is the temperature at time t , k is a constant, and m is the mass of the body that is cooling. Strategies (a) and (b) will then lead to the temperatures

$$T_a(t) = \frac{MT(0)}{M+m} \exp\left[-\frac{kt}{M+m}\right]; \quad T_b(t) = \frac{MT(0)}{M+m} \exp\left[-\frac{kt}{M}\right].$$

It is easy to see that strategy (b) leads to the lower temperature. [If we take evaporation losses into account, then the conclusion still holds if we assume that, when the volume of the liquid is increased, the surface will be closer to the top of the mug.]

The Devil's Tree or Scholar's Tree

(*Alistonia scholaris*)

Know Thy Trees - 8

Arvind Gupta and
Arvind Paranjpye



The generic name commemorates a distinguished botanist C. Alston of Edinburgh 1685-1760. The specific name scholaris refers to the fact that the timber of the tree was used in the past for making slates for school children. The Marathi name Satvin, refers to the number of leaves (seven) emerging from any branch or node. In some parts of the country, the tree is considered to be an abode for evil spirits, hence the name Shaitan or Devil's Tree.

It is a tall, elegant tree with a grayish bark. Branches come out in whorls from the main trunk very much like the ribs of an umbrella. Come November and the fragrance of the insignificant greenish-white flowers is heady. Slender pendulous fruits hanging down in clusters from the branches can be as long as 30-60 cm.

The boundary wall of the rose garden in IUCAA is lined with seven specimens of this tree.

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

We welcome your responses
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