IIA Newsletter

Volume 14 No. 1 | Indian Institute of Astrophysics | March 2009

In this issue...

From the Director's Desk

I would like to welcome the new editorial team consisting of Prajval Shastri and S.P. Rajaguru as well as place on record my appreciation to the previous editors D. C.V. Mallik, Dipankar Banerjee and Baba Verghese for shouldering the responsibility of resuming the IIA newsletter which had become defunct for several years. I greatly enjoy reading the newsletter and am most grateful to them for putting the whole process on a firm track. The choice of material as well as the balanced coverage of topical events has ensured that the newsletter is widely read. I have every confidence that the new editors will also maintain the high standards set by the previous team.

IIA had an exciting close to 2008. The Institute commemorated the centenary of the Evershed effect, discovered in Kodaikanal, by organizing an international conference on "Magnetic coupling between the interior and the atmosphere of the Sun" in early December. An equally busy and exciting beginning to 2009 was the international conference on "Recent advances in Spectroscopy" at Kodaikanal in January and the hosting of the 27th Meeting of the Astronomical Society of India, in February, 2009. In addition, we have stepped into the International Year of Astronomy, a celebration initiated by the International Astronomical Union and UNESCO, to commemorate 400 years since Galileo Galilei first used a telescope to make his landmark discoveries. The IYA vision is to bring home to everyone the impact of astronomy and the scientific method on people's daily lives, and to understand how scientific knowledge can contribute to a more equitable and peaceful society. Its slogan 'The Universe, Yours to Discover', is in the spirit of the path that Galileo chose to take. The world-wide celebrations were inaugurated with an Opening Ceremony Conference on the January 15, 2009 at the UNESCO headquarters in Paris in which I participated and presented an update of Indian programmes. IIA had several preparatory activities last year in the run-up to IYA 2009, including a multi-disciplinary workshop on 'Universalising the Universe' at IIA. IIA has initiated its IYA09 activities with the launch of its 100 Lectures Series, organizing an astronomy tableau at the Republic Day parade in New Delhi, and also commissioning a play on Galileo. Other activities are reported in this newsletter.

An exciting event for astronomy enthusiasts has been the appearance of Comet Lulin. While the high levels of light pollution precluded finding the comet in Bangalore's skies, visitors to VBO were able to view the exotic object. Several astronomers, mainly amateurs, who were at remote locations also enjoyed its beauty as it sailed across the sky.

I am happy to see the extensive coverage that the present newsletter provides of IIA activities in the last three months. I wish the newsletter all the best.

- Siraj Hasan

Evershed Centenary Conference

An international conference on 'Magnetic Coupling between the Interior and the Atmosphere of the Sun' was organized by IIA, during 2 - 6 December, 2008, at its Bangalore campus, to commemorate 100 years since the discovery of the Evershed effect. This meeting attracted a large number of leading experts in the study of the Sun, from all over the world, and provided an excellent forum for them, thanks to the smooth organizational support from the LOC and administrative staff of the Institute, to present and discuss the latest results encompassing all aspects of solar magnetism.

The inaugural session of the meeting, in the morning of 2nd December, started with a welcome address by the Director of IIA, Siraj Hasan, who gave a historical account of research at the Kodaikanal Solar Observatory and the life and work of John Evershed at Kodaikanal. He also summarised the current research activities and major projects planned for the near future in solar physics at IIA. Renowned solar physicist Eric Priest from the University of St. Andrews, Scotland, then made opening remarks followed by the formal inauguration and address by the Chairman, Governing Council of IIA, K. Kasturirangan. He also released a brochure on 'John Evershed and Solar Physics at the Kodaikanal Observatory' brought out by the IIA.

The scientific programme consisted of six oral sessions spread over the four days of the meeting schedule Posters, about 80, grouped similarly into six topics were on display throughout the meeting. The oral sessions had 33 invited reviews and talks, and 20 contributed talks. There were about 120 participants, including about 58 from abroad.

The first day's scientific sessions covered magnetic field generation in the solar interior, magnetoconvection and transport, and local helioseismology of sunspots and associated structures. Current ideas on the transport of angular momentum across the solar tachocline, state of the art numerical simulations of interior convection, rotation and dynamo processes as well as predictions of solar cycles based on mean-field kinematic dynamo models were presented. The current state of affairs in the subject of sunspot seismology, and the problems and issues that need to be tackled were part of the discussions in the last session of the first day.

New techniques to measure magnetic fields in the weak field small-scale regime, where Zeeman diagnostics fail, were pointed to and discussed on. Advances in polarized radiation diagnostics towards measuring field strengths in the chromosphere and corona were discussed. Various new instruments, recently commissioned as well as those planned, including the THEMIS facility in France, SHAZAM instrument being developed in the USA for the Dunn Solar Telescope and the Swedish Solar Telescope, and capabilities of back-end instruments for magnetic field measurements being developed for MAST (Multi-Aperture Solar Telescope, Udaipur Solar Observatory) and that being planned for the NLST (National Large Solar Telescope, IIA) were presented and discussed. Theoretical

predictions for the probability distribution functions for both vertical and horizontal small-scale magnetic fields were presented. The agreement of such predictions with measurements using high-resolution polarimetry from space on Hinode (a Japanese-USA collaboration) was suggested to reflect the action of local dynamo in maintaining the small-scale fields.

Study of the dynamics of emerging magnetic flux regions has received a tremendous boost from excellent data provided by instruments on-board Hinode. Statistical analyses of such data were presented by Hinode science experts from Japan, with highlights on transport of magnetic helicity into the corona by the twisting motions driven by sub-surface dynamics of flux ropes.

The last session on day 2 was on 'Sunspots and Active Regions', which continued on to the next day. Different theoretical models on the interior structure and dynamics of sunspots were critically assessed in the light of various new high-resolution surface observations. Association between the thermal and magnetic signatures in the penumbral regions were critically examined, with a fine summary of current understanding of these features. The Wilson effect and physics of Wilson depressions were the subject of a research effort carried out using a long time base white light image data from the Kodaikanal Observatory, and the presented results received critical assessment from the assembled experts. Numerical modelling of wave phenomena has seen rapid advances in recent years and the key results that have emerged were part of an elegant presentation. Continuation of discussions on 'Sunspots and Active Regions' on day three focussed on new results from very high-resolution observations using Hinode, including Doppler images of the Evershed flow structures.

The nature of heating processes in the corona, especially the dissipation of magnetic energy into heat observed as EUV and soft X-ray emission, as well as the plasma radio emission at low-frequency, is the subject of numerous models invoking either steady or impulsive processes. Results, again based on Hinode data, that provide support for the concept of multistranded nanoflare impulsive processes were presented. On the issues of heating the chromosphere and transition region, the latest Hinode observations that reveal fine dynamic fibrils, and spicules with heights of about 500 km and velocities of 50-150 kms^{-1}, together with high-speed upflows at the feet of coronal loops were presented and discussed. There were also reports on the recently developed 3D codes that follow flux emergence into a pre-existing field, and the development of loops and spicules.

The last day's deliberations focussed on eruptive phenomena: flares and coronal mass ejections (CME's). Theoretical and numerical models, as well as recent empirical results, especially on the energetics and helicity accumulation, formed the major part of the discussions. Results on waves and turbulence in the solar wind, based on continuing radio observations of interplanetary scintillation, were presented with significant inferences on the presence of Alfvén and ion cyclotron waves at distances of $50R_{\odot}$. Plans on *in situ* measurements of the solar wind flux on and near the surface of the Moon by the SWIM mass spectrometer on the recent Indian lunar mission Chandrayaan-1 were talked about.

The last session of the meeting focussed on Sun as a star, and on magnetic activity phenomena in distant stars. Comparisons of Sun in X-rays, with data from ROSAT mission on other main sequence stars, were made. The Sun is shown to be a relatively weak X-ray source but stellar flares are common on more active stars, ranging from fully convective late-M dwarfs to massive post-main sequence giants. Extensive data sets on several proxies of magnetic activity, like the Ca II emission and FIP effect, have been accumulated and the potential to study detailed aspects of solar-stellar connections were pointed to with discussions on representative new results.

Quoting Nigel Weiss, who gave the 'Conference Summary & Perspective', 'the most striking impression given by the papers in this conference is of the enormous wealth of new observations that have been generated

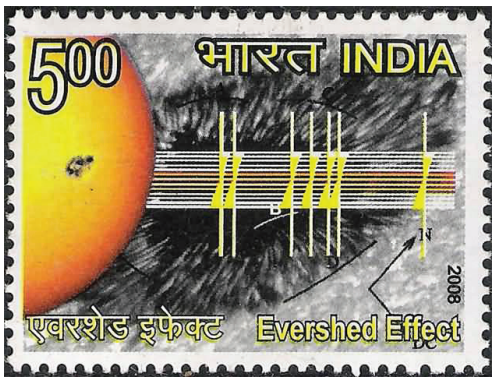
within the last fifteen years, both from space – with Yohkoh, SoHO and most excitingly with Hinode and also from the ground – most notably with the Swedish Solar Telescope and the upgraded Dunn Solar Telescope'. An excursion to the Kodaikanal Solar Observatory, about 350 kms from Bangalore, followed the closing of the conference in the evening of the 5th December. About 20 enthusiastic participants went on this excursion.

Release of Postage Stamp

On the occasion of the Evershed centenary conference, a commemorative stamp and a first day cover on the Evershed Effect were released at a special function at IIA on the 2nd December, 2008.

The postage stamp being released by M P Rajan, Chief Post Master General, Karnataka

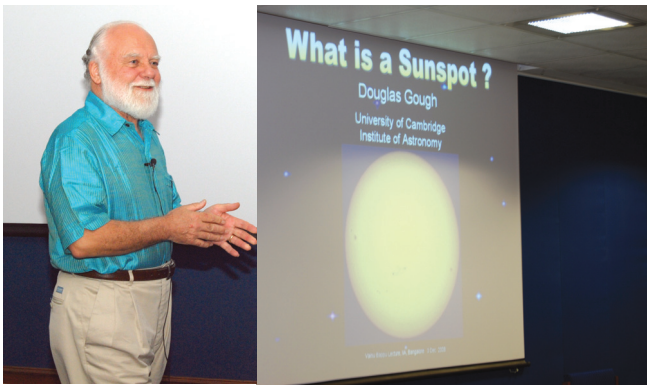
First Day Cover (above) and Stamp (below) of the Evershed effect



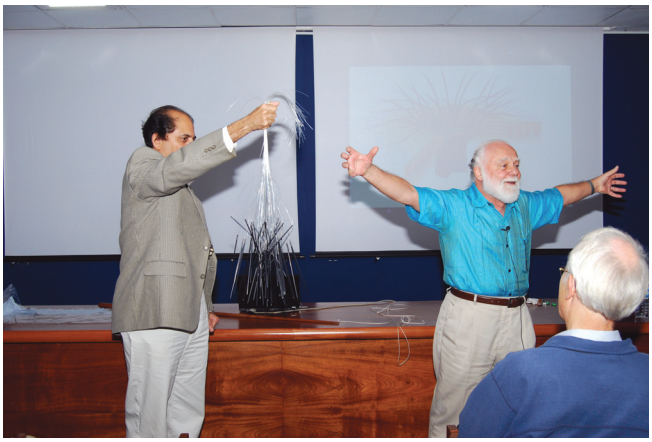
Vainu Bappu Memorial Lecture

The 2nd Vainu Bappu Memorial Lecture was delivered by Douglas Gough, Leverhulme Emeritus Fellow, Institute of Astronomy, University of Cambridge, on the 3rd of December, 2008. This public lecture occurred on the occasion of the Evershed centenary conference at IIA.

The evening started with a formal introduction of Douglas Gough by Shashikumar Chitre, member, Governing Council of IIA and a contemporary of the speaker at Cambridge. He also read out the citation from the scroll of honour. Douglas Gough had chosen a fascinating aspect of the



Sun, the sunspots, with a title 'What is a sunspot?' for his lecture. He enthralled a packed house with his articulate account of solar magnetism and its dominant portrayal in the form of sunspots, and how the human inquiry lasting over several centuries has advanced. He described how the discoveries of George Ellery Hale and John Evershed at the turn of the last century revolutionized our understanding of sunspots, and the fundamental issues in understanding the overall working of the Sun in producing its 11 year sunspot cycle. Douglas's well known ability to involving his audience in the joy of thinking was evident when he did a practical demonstration on stage, with the help of a member of the audience (the director of IIA), of the mutual repulsion of a collection of similarly polarised magnetised wires to illustrate possible mechanisms that could hold a sunspot composed of flux tubes stable. He went on to describe how helioseismology, a subject that has seen leading and pioneering contributions from him, has revolutionized our understanding of the differential rotation and the depth of the convection zone, which are crucial elements in modelling the solar dynamo. He, however, pointed to the basic nonlinearities in the fundamental physical processes involved in the momentum and energy exchange in the interiors of stars and the consequent unpredictability of sunspot cycles.



Douglas Gough is a Fellow of Churchill College, and formerly Professor of Theoretical Astrophysics at the University of Cambridge. In 1997 he was elected Fellow of the Royal Society. He has worked on the theory of convection, and on the pulsations of stars. His pioneering work in helioseismology is now being extended to asteroseismology, an area of research which is presently in its infancy, and which promises to further refine our understanding of the structure and evolution of stars. He has played significant roles in the development of the GONG project, the helioseismological experiments on SoHO, and observational programmes in asteroseismology.

Vainu Bappu Visiting Professor

Jan Olof Stenflo, Emeritus Professor, Swiss Federal Institute of Technology (ETH), Zurich, was appointed the first Vainu Bappu Visiting Professor at IIA. Jan Stenflo is a renowned solar physicist with a very distinguished academic career. His seminal contributions to solar physics have included several fundamental discoveries on the nature of solar surface magnetism, especially on small scales, through the development of novel observational techniques. His invention of the line-ratio technique in 1971 revolutionised the study of unresolved magnetic fields, and led to the discovery of kilo-Gauss strength magnetic flux elements as a dominant form of magnetic flux through the solar photosphere. He is also well known for his work on applications of atomic and quantum physical phenomena to the study of polarised radiative transfer including scattering in the solar atmosphere, and is credited with the discovery of 'second solar spectrum' through a survey of scattering polarization from the deep UV to the infrared. Among the many honours he has received is the Prix Janssen of the Société Astronomique de France in 2008, and the minor planet 70737 in orbit between Mars and Jupiter being named "Stenflo" in 2007. Jan Stenflo visited the institute for two weeks in December, 2008. Apart from an invited talk at the Evershed Centenary Commemoration conference during 2 - 6 December, 2008, he also gave a public lecture on the 8th December 2008 titled "Our nearest star, the Sun" and delivered the institute colloquium on the 23rd December 2008 titled "The Second Solar Spectrum".

Asteroids ‘Bhattacharyya’ and ‘Gokumenon’

The IAU Committee for Small Body Nomenclature (CSBN) has recently named two asteroids discovered from the Vainu Bappu Observatory in Kavalur, after M G K Menon and J C Bhattacharyya. In January 1987, IIA had launched Project Kalki led by R Rajamohan to survey and discover asteroids, comets and the elusive tenth planet of the Solar System (cf. Newsletter, Vol.4, Oct. 1989). Tom Gehrels of the University of Arizona, USA, an authority on solar system was also involved in the shaping of the programme. A 45-cm Schmidt telescope at the observatory was used for the survey. It had a field of view of 3^o x 4^o and a plate scale of 150 arc second per millimetre. During the few years that Project Kalki was in operation, it discovered a total of six asteroids.

On February 17, 1988, its first discovery was made by the project team consisting of R. Rajamohan, V. Moorthy, K. Kuppuswamy and A. Paranjpye. This was also the first discovery of an asteroid from an Indian observatory in the twentieth century. Between 1861 and 1885, Norman Pogson, Astronomer in the Madras Observatory, the institution to which IIA traces its origin, had discovered five asteroids from Madras (now Chennai). The asteroid was recovered close to its predicted position (based on an orbit calculation programme developed by R. Vasundhara in IIA) on plates taken at VBO by V Moorthy in May 1989. The asteroid was named Ramanujan after mathematician Srinivasa Ramanujan (M.P.C. 15 262, 14 Oct. 1989). Another five asteroids, discovered between 1988 and 1990 under the same project were assigned the temporary names 1988 DR, 1989 CD4, 1988 CA, 1988 BX and 1990 BC2. Their paths were followed at VBO until about 1992. They were numbered 4706, 5178, 7564, 8348 and 17446 respectively. The objects 4706 and 5178 were later named Dennisreuter (M. P. C. 52766, 28 Sept. 2004) and Pattazhy (M. P. C. 56611, 2006 Apr. 13) respectively, after Dennis C. Reuter, a physical chemist in NASA, USA, and Sainudeen Pattazhy, an environmental scientist in India. R Rajamohan proposed that asteroid 8348 be named ‘Bhattacharyya', after the IIA director at the time, and that asteroid 7564 (1988 CA) be named ‘Gokumenon', after the then Chair of IIA's governing council, MGK Menon (M. P. C. Circular 63639 dated Aug. 19, 2008). ‘Gokumenon' and ‘Bhattacharyya' now join Ramanujan (4130), Vainu Bappu (2596), Mrinalini (2986) and Sarabhai (2987) in the sky.

- D. C. V. Mallik

Lecture Course at Udaipur

S. Chatterjee was invited by the physics department of the Mohan Lal Sukhadia University, Udaipur to give a series of lectures on "Optical and Near IR studies of Stars and Galaxies", to the M.Sc. students who specialise in astronomy. The course of eight lectures, conducted during 15 - 20 January, 2009 were attended by eight M.Sc. students. The course covered interaction of radiation with matter, elements of spectroscopy and radiative transfer and related empirical results.

ASI XXVII 2009

IIA hosted the meeting of the Astronomical Society of India after a gap of 23 years. The meeting was held in the IIA campus, and had over 250 participants.The Presidential address by Jitendra Nath Goswami was followed by the award ceremony of the Vainu Bappu Memorial Gold Medal. The awardee, Banibrata Mukhopadhyay of IISc delivered the Vainu Bappu award lecture, entitled 'Measuring Spin of Black holes from their QPOs: A Test of General Relativity'.

The special scientific features of the meeting were two mini-symposia, 'The Dynamic Sun' and 'Star-formation History'. There were 17 invited scientific talks on solar, stellar, Galactic and extragalactic astrophysics, and over 160 poster presentations. Specific time of 3 hours was allotted for poster-viewing and interactions, besides which five rapporteurs summarised the posters in the plenary session. There were six talks in the customary session for PhD theses summaries. There was a session entitled 'New Initiatives', which included talks describing new astronomy and data facilities in the country, as well as one on the outreach initiatives by Vigyan Prasar of DST.

Jayant Narlikar delivered an evening lecture titled 'How Astronomy has Contributed to Enrichment and Survival of Human Societies' to a packed auditorium that included members of the public. A notable feature of the ASI was a late-evening "reminiscences" session, in which the past presidents of ASI dwelt on the contributions by the late Krishna Damodar Abhyankar, his initiation of the formation of the ASI and later, his persistent efforts to sustain it.

There was a parallel meeting of the Forum for Resource Sharing in Astronomy, in which librarians of IIA, RRI, TIFR, IUCAA, NCRA and ARIES came together to discuss digitisation projects, and implementation of open access repositories. In addition, IIA organised a digital exhibit of astronomical photography by amateur astronomers, and the performance of a play on Galileo.

G. C. Anupama was Convenor of the local organising committee, which received excellent support from the administrative, computer support and library staff of IIA. In addition to IIA, the meeting was sponsored by PRL, IUCAA, ARIES, ISRO, TIFR, RRI and HRI, and also received support from Allied Publications, Cambridge University Press and Elsevier Science.

Pro-Am Workshop

On the 17th February, 2009, the day before the scientific sessions of the meeting of the ASI began, the ASI and the Bangalore Planetarium co-organised a workshop

Amateur astronomers who ran the "Messier Marathon" at IIA's Hosakote campus. (Photo credit: Naveen Nanjundappa, Bangalore Astronomical Society).

titled "Amateur Astronomy: Pro-Am Collaboration" at the planetarium. Amateurs and professionals from all over the country took part.

Several IIA scientists participated, and Vasundhara Raju gave an invited talk on "Asteroid Occultation: Amateur-Professional Collaboration". The discussions made a clear case for substantive collaborative possibilities between amateurs and professionals. The gathering with so many talented and enthusiastic amateur astronomers inspired by the beauty of the cosmos made for a highly energising experience. The discussion session was followed by a "Messier Marathon" of sky-watching at IIA's Hosakote campus, co-ordinated by Tushar Prabhu.

Recent Advances in Spectroscopy: An International Conference at Kodai

Spectroscopy is a critical tool to derive key astrophysical parameters such as temperature, density, chemical composition, velocity and magnetic fields. Further, a multi-disciplinary approach to spectroscopic investigations is essential to address the complex phenomena that arise in astrophysical settings. To bring together experts in the areas of theoretical and experimental atomic physics, and observational astrophysics, an international conference on 'Recent Advances in Spectroscopy: Theoretical, Astrophysical, and Experimental Perspectives' was organised at Kodaikanal during 28 - 31 January, 2009. The conference was sponsored by IIA, DST, CSIR and BRNS.

There were about fifty participants, from both India and abroad. The conference began with a welcome note and opening remarks by M. V. Mekkaden. There were sessions on theoretical and experimental aspects of atomic and molecular spectroscopy, line formation in stellar atmospheres, and observations and analysis of solar and stellar spectral lines. In addition to the scientific sessions, the schedule of the conference was designed to facilitate mutual interactions among the participants and foster new collaborations. A special talk was delivered by D. C. V. Mallik on 'Vainu Bappu and the Quest for High-Resolution Spectroscopy at the Indian Institute of Astrophysics'. The conference summary was by Tushar Prabhu and the vote of thanks by Rajat K. Chaudhuri.

- Rajat K. Chaudhuri & M. V. Mekkaden

Spectroscopists at Kodai

Lecture Course on Extra-solar Planets

A five lecture course on 'Extrasolar Planets' was given by Dimitar Sasselov from the Harvard-Smithsonian Center for Astrophysics, while he was visiting the IIA, Bangalore during January 16 - 28, 2009, to a sizeable audience of astrophysicists and students. Dimitar Sasselov is Professor of Astronomy and Director, Harvard Origins of Life Initiative, at the Harvard University, Cambridge, USA.

Research on extrasolar planets is one of the most exciting and frontier fields of modern astronomy and astrophysics, and Dimitar being a leading figure in this field, the audience to his course had a great opportunity to learn both the basics and the latest research in this field. Dimitar's course covered the astronomical techniques involved in the search for and discovery of exo-planets as well as the astrophysics, physics, and chemistry behind the structure and evolution of gas giant and terrestrial planets in the universe. The multi-disciplinary nature of research on exo-planets was well conveyed in this short and well balanced course, and much of the audience had entirely new things to learn from Dimitar, e.g. the physics and astrophysics of earths and super-earths that are not normally covered in the mainstream astrophysics courses. Dimitar has made his lectures available at http://www.cfa.harvard.edu/~sasselov/IIAP/.

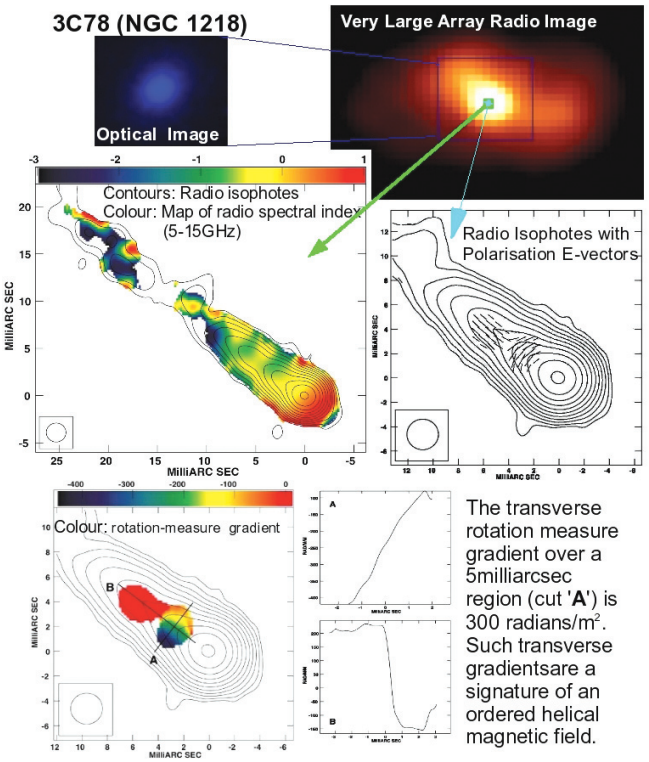
The Hearts of Radio-powerful Active Galaxies with Interferometric Polarimetry

The minority of galaxies that are in an active phase are powered by their central accreting supermassive black holes. Relativistic bipolar jets of plasma are produced from their nuclei with enormous kinetic energy, sufficient to propel the jets out of the host galaxy and into the intergalactic medium. These jets emit strongly at radio wavelengths via the synchrotron mechanism, and this is how they are most easily and most often seen. Ordered magnetic fields generated in the vicinity of the accreting black holes are thought to be instrumental in launching and collimating these jets, but the exact mechanisms are still debated and remain untested empirically.

These radio-powerful active galaxies exhibit a broad dichotomy in the morphology of their jets, that roughly follows a dichotomy in total radio power, known as the Fanaroff-Riley divide.The low power Fanaroff-Riley galaxies of 'type I' show flaring jets with no clear termination points, while the high powered Fanaroff-Riley type II galaxies show collimated jets with distinct terminal `hotspots'. Both types of jets are relativistic at launch, but while the high-powered jets remain relativistic almost up to the termination points, the low-powered jets decelerate relatively close to their origins. The factors that cause the Fanaroff-Riley divide are yet unknown.

The hearts of radio-powerful active galaxies on parsec-scales including their magnetic field geometry have been studied quite extensively via interferometric polarimetry in those cases where the relativistic jets point close to the line of sight, since the resultant Doppler boosting brings them well within the sensitivity limits of current instrumentation. Interestingly, for a handful of these "boosted" objects, Faraday Rotation measurements have shown transverse rotation measure gradients across the jets (Gabuzda, Murray & Cronin 2004), which could be interpreted as a signature of helical magnetic fields in them (Blandford 1993). Those radio-powerful active galaxies whose bipolar jets are directed away from our line of sight and are therefore not significantly Doppler-enhanced, are far less amenable to such observations, and only a handful figure in the literature (Kharb, Shastri & Gabuzda 2005; Taylor 2006 & references therein). Thus, ordered magnetic fields on parsec scales in such "unbeamed" nuclei are known only in a few objects, and multi-frequency polarimetric data required to infer the Rotation Measure are available for fewer still.

For four of such unbeamed radio-powerful galaxies we had reported the detection of polarisation in their nuclei on parsec scales, implying the unambiguous presence of ordered magnetic fields, deemed essential to launch the bipolar jets (Kharb, Shastri & Gabuzda 2005). The detections were possible because we included telescopes with large collecting area (viz., those at Efflesberg, Germany and Westerbork, Netherlands) in our global Very Long Baseline Array. For three of the galaxies we now have parsec-scale multi-frequency polarimetric measurements. These measurements were made using a global interferometric array that included all ten telescopes of the Very Long Baseline Array (USA) and the 100-metre Efflesberg telescope. The frequencies of the measurements were 5, 8 and 15 GHz. In one of the three galaxies, viz., 3C78 (NGC1218), polarisation was detected at all three frequencies, yielding unambiguous Faraday rotation measure estimates. Interestingly, this galaxy shows evidence for a Faraday Rotation measure gradient transverse to the jet, similar to the results of Gabuzda, Murray & Cronin (2004), but for an "unbeamed" radio galaxy. Based on this gradient, the large Faraday rotation and the small depolarization, we argue that a layer surrounding the jet and carrying a helical magnetic field forms the Faraday screen. Details of these results will appear in the Astrophysical Journal (Kharb, Gabuzda, O'dea, Shastri & Baum, 2009).



The radio image on kiloparsec scales shows a jet towards the north-east and a fainter "bent" counter-jet both of which peter out without any bright terminal shocks (Fanaroff-Riley type I) The galaxy is an elliptical (top left). In our zoomed-in parsec-scale radio image obtained with very long baseline interferometry apart from the north-eastern nuclear jet, a very small faint counter-jet is also clearly discernible because of it being optically thin (bluish-green: steep spectrum) as against the optically thick nucleus (red: flat spectrum) The polarisation E-vectors have effects of Faraday rotation removed.

References:

Blandford R. D., 1993, Astrophysical Jets. Space Telescope Science Inst. Symp. Ser.6, eds. Burgarella, et al (Cambridge Univ. Press), p.15

Gabuzda D. C., Murray E. & Cronin P., 2004, MNRAS, **351**, L89

Kharb P., Shastri P. & Gabuzda D. C., 2005, ApJ, **632**, L69

Taylor G. B., et al 2006, MNRAS, **368**, 1500

- Prajval Shastri

Line-of-sight Depth of the Large and Small Magellanic Clouds

The Large and Small Magellanic Clouds (LMC & SMC) are our nearest neighbours and are both irregular face-on galaxies. They are at distances of 50 kpc and 60 kpc respectively from our Galaxy. They interact with each other as well as with our Galaxy, which has disturbed their structure. Estimation of the extent of these galaxies in the line of sight is important to understand their structure and also their contribution to self-lensing in the observed micro-lensing events.

We present a systematic estimation of the line-of-sight depth (front to back extent of the disk) of the Magellanic Clouds using red clump stars as tracers. The dispersion in the distributions of their colour and magnitude are derived from photometric data (V & I bands) from the Optical Gravitational Lensing Experiment (OGLE II) and Magellanic Clouds Photometric Survey (MCPS) and used to estimate the depth. The observed dispersion in colour distribution is due to a combination of internal reddening within the Clouds, observational errors and population effects. The dispersion in magnitude distribution is due to internal disk extinction, depth of the region, population effects and photometric errors. Differences in age, metallicity and star formation rate contribute to the intrinsic spread in the colour and magnitude distributions. The spread due to population effects in red clump stars is modeled by Girardi & Salaris (2001) and we adopt these values to account for the population effects. By deconvolving other effects from the dispersion of magnitudes, we estimate the dispersion due to the depth of the disk.

Both the Magellanic Clouds are found to have large line-of-sight depth. The LMC bar is flared and the LMC northern disk is found to have greater depth or a different population than the southern disk. The bar and the disk of the SMC have similar depths, with no significant depth variation across the disk. The most prominent feature in the SMC depth profile is the increased depth seen near the optical centre, where the depth profiles, averaged over right ascension and declination, resemble the structure of a bulge. The inferred LMC depth is lower than that derived using RR Lyrae stars (which are tracers of the halo). This suggests the existence of an inner halo in the LMC bar region. In the case of the SMC, the depth estimated by RR Lyrae stars and red clump stars is similar. The increased depth near the optical centre is also seen in the RR Lyrae depth estimates. Both the RR Lyrae stars and red clump stars co-exist in the bulge. The stellar density distribution of the SMC (MCPS data) is enhanced near the optical centre where we obtained a greater depth. The central concentrations of AGB and RGB stars identified by Cioni et al (2000) and HI concentration detected by Stanimirivic et al. (2004) are also located within the region of increased depth. Thus, the co-existence of RR Lyrae stars and red clump stars in the central volume, along with the increased depth and stellar and HI density near the optical centre, suggest that the SMC possibly has a bulge. The central bar may be this deformed/extended bulge. The results will appear in Astronomy & Astrophysics (S. Subramanian & A. Subramaniam: astro-ph/0809.4362).

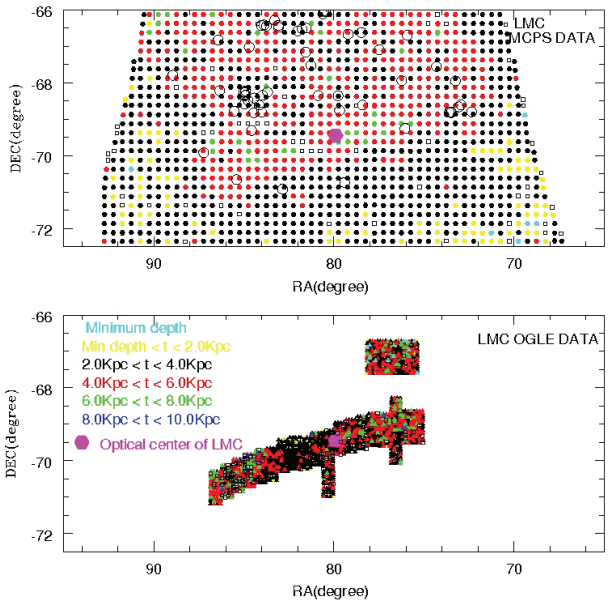
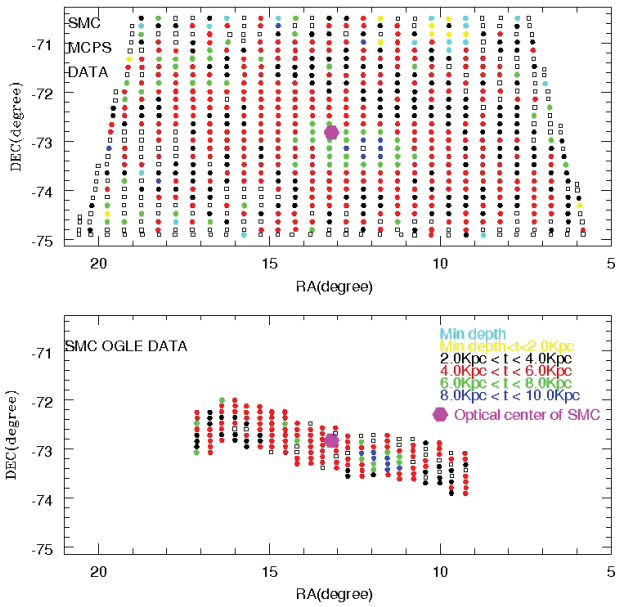


Figure: Two-dimensional plots of the depth in the LMC (upper figures) and SMC (lower figures)



References:
Cioni, M.-R.L. et al 2000, A & A, 358L, 9
Girardi, L., & Salaris, M., 2001, MNRAS, 323, 109
Stanimirovic, S. et al 2004, ApJ, 604, 176

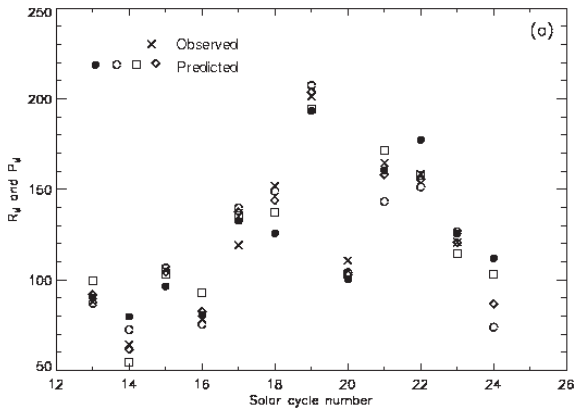
- Smitha Subramanian

A Prediction for Amplitude of Solar Cycle 24

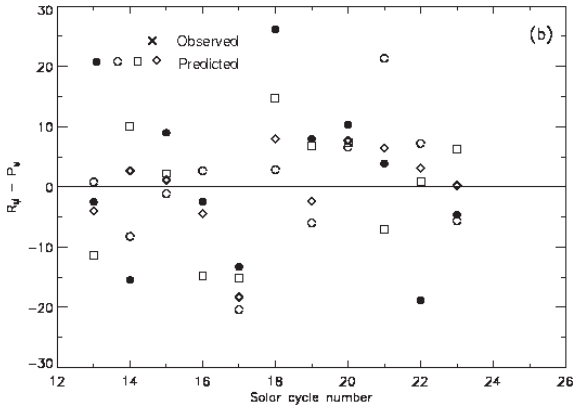
A large number of forecasting methods (precursors, spectral analysis, non-linear dynamics, solar system dynamics, etc.) are used to predict the amplitude, i.e., the maximum number of sunspots of the 11-year solar cycle. Among all the methods, the precursor method based on the correlation between the strength of a geophysical phenomenon in the declining phase of a cycle

and the strength of its immediate following cycle, initiated by Ohl(1966), seems to be the most successful one (Kane 2007). Based on an earlier analysis of Greenwich and Solar Optical Observing Network sunspot group data covering the period 1874-2006, we found that: (i) the sum of the areas of the sunspot groups in the 0° – 10° latitude interval of the Sun's northern hemisphere and in the time-interval of -1.35 year to +2.15 years from the time of the preceding minimum of a solar cycle n correlates well with the amplitude (maximum of the smoothed monthly sunspot number) of the cycle n + 1 (correlation coefficient r = 0.947); (ii) we also found that the sum of the areas of the spot groups in the 0° – 10° latitude interval of the southern hemisphere and in the time-interval of 1.0 year to 1.75 year just after the time of the maximum of the cycle n correlates very well (r = 0.966) with the amplitude of cycle n + 1 (Javaraiah 2007).

With further analysis of the data, we have found that the north – south asymmetries in the sums of the areas of spot groups in the 0 - 10° latitude interval have a strong ~44-year periodicity, and from this we can infer that the upcoming cycle 24 will be weaker than cycle 23. We further find that the north – south asymmetry in the area sum of a cycle n also has a relationship with the amplitude of cycle n + 1, which is similar to (i) but with a higher correlation coefficient (r = 0.968). Using this correlation, it is possible to predict the amplitude of a cycle with a better accuracy by about 13 years in advance, and we get 103 ± 10 for the amplitude of the upcoming cycle 24. Additionally, we found a similar relationship with an even higher correlation coefficient (r = 0.983), by using the sum of the area used in (ii) above and the north – south asymmetries in the sums of the areas of spot groups in the 0 - 10° latitude interval. Using this last correlation, it is possible to predict the amplitude of a cycle by about 9 years in advance with a high accuracy, and we get 87 ± 7 for the amplitude of cycle 24, which is about 28% less than the amplitude of cycle 23. Our results also indicate that cycle 25 will be stronger than cycle 24. The variations in the mean meridional motions of the spot groups during odd and even numbered cycles suggest that the solar meridional flows may transport magnetic flux across the solar equator and are potentially responsible for all the above relationships. (Appeared in Sol. Phys. 252, 419, 2008.)



Against the Solar cycle number are plotted the observed and simulated amplitudes (panel.a) and the differences between the observed and simulated amplitudes (panel.b)



References:
Ohl, A. I. 1966, Son. Dannye 12, 84.
Javaraiah, J. 2007, MNRAS 377, L34.
Kane, R. P. 2007, Solar Physics 243, 205.

- J. Javaraiah

Comet Lulin

Comets are solar system objects that have highly elliptical orbits around the Sun. They are typically a few to tens of kilometres across and are made up largely of ice, dust and small rocky particles. When comets approach close to the Sun, their ice evaporates, creating a fuzzy-looking "atmosphere" or coma. The gas and dust of this coma are then pushed away by the solar wind, producing the long, dramatic tails that comets are most known for.

Comet Lulin (C/2007 N3) was discovered by Quanzhi Ye, a 19 year-old student at Sun Yat-sen University in mainland China, as an apparently asteroidal object on images taken by Chi Sheng Lin (National Central University, Taiwan) with a 16-inch telescope at Lulin Observatory in Taiwan on the night of July 11, 2007. A week later, confirming images revealed the tell-tale presence of a coma. In China and Taiwan, the comet has been hailed as the "Comet of Co-operation". It was closest to earth on the 24th February, 2009 (at a distance of 61 million kilometers). Around this time, several people people reported seeing it with their naked eyes from locations away from the polluted skies of Bangalore. Visitors to VBO were shown the comet on February 20, 21 and 22nd.

Comet Lulin photographed on the night of the 26th February, 2009 at the Vainu Bappu Observatory, with an EOS 300D Canon digital camera that rode on the small "guide telescope" attached to the 40" telescope (exposure: 7min, at 21hrs UT). Star trails are also seen.

- Photo credits: K Kuppuswamy, P Anbazhagan, M Muniraj & R Ganesan

As part of its run-up activities to the IYA09, IIA co-organised a parallel session on IYA09 in the 12th All-India Peoples Science Congress at Ranchi, on the 20th December, 2008. About 600 delegates from all over the country and about 2000 participants from Jharkhand, including scientists, educationists and science popularisers, participated in the conference. In the IYA09 session, Sabyasachi Chatterjee gave a talk on "Galileo's Revolution and the Significance of IYA", and Prajval Shastri gave a talk on "She is an Astronomer", in addition to talks on Understanding the Sun, and Ancient Indian Astronomy. In the session on Science Communication, Sabyasachi Chatterjee gave a talk on "A Peoples' Science Perspective on Science Communication".

The Indian Astronomical Observatory (IAO) of IIA, Hanle, plans to participate in the programme "24-hour webcast from research observatories" as a part of "100 Hours of Astronomy" Cornerstone Project under IYA 2009. The webcast runs from 2009-04-03 09:00 UT to 2009-04-04 09:00 UT and the slot for the Himalayan Chandra Telescope of IAO is between 18:40 and 19:00 UT. The event is coordinated by the European Southern Observatory and further details will be announced by ESO on the 100 Hours of Astronomy website: http://www.100hoursofastronomy.org/.

- Tushar Prabhu

On behalf of the Department of Science and Technology, IIA designed and presented a tableau on astronomy at the Republic Day Parade in New Delhi, on the 26th January, 2009. The current Indian Astronomy scene was exemplified in the theme of the tableau by several exhibits. A model of a radio interferometric telescope represented the Giant Metrewave Radio Telescope operated by the Tata Institute of Fundamental Research in Maharashtra, and a model of an optical telescope represented IIA's Vainu Bappu telescope. In addition, the beauty of the cosmos was displayed through a running slide show of astronomical images on large digital screens, and also present were professional astronomers shown interacting with people representing the ever-curious public.

The Astronomy tableau at the Republic Day parade in New Delhi

On the occasion of IYA 2009, a special weekly visitors programme has been launched by VBO. The programme is intended for school/college/university students, and consists of an astronomy lecture, a tour of the observing facilities, an astronomy movie and night-sky watching.

- C. Muthumariappan

A major outreach activity initiated by IIA in IYA09 is the '100 lectures' series, a set of 100 public lectures to be given by IIA scientists to student and public audiences.

This series was kicked off by Tushar Prabhu, with a lecture at Milind Science College, Aurangabad, on the 20th January, 2009, on 'Evolution of Telescopes and the Indian Astronomical Observatory'. This was the keynote address at a national-level Seminar on "Observational Facilities for Astronomical Studies". The other talks given in this series so far:

* Padmakar Parihar: *Observing Variable Stars Using a Small Telescope, Milind Science College, Aurangabad (20 Jan)*
* Padmakar Parihar: *Orion Nebula: A Stellar Nursery, Milind Science College, Aurangabad (21 Jan)*
* Bhuwan Bhatt: *Astronomy: An Observational Science, Vivekananda High School, Sulebele, Hosakote Taluk, Karnataka (31 Jan)*
* Palahalli Vishwanath: *Galileo: The Scientist and the Man, JN Planetarium, New Delhi (4 Feb)*
* S Chatterjee: *Revolutionaries in Science: Galileo and Darwin, Vijnan Darshan, Bangalore (12 Feb)*
* S Chatterjee: *A Journey into our Galaxy Mariam Nivas School, Bangalore (14 Feb)*
* Palahalli Vishwanath: ಆಕಾಶ ಮತ್ತು ಗಲಿಲಿಯೋ, *"The Sky and Galileo"*, in Kannada, *Bharatiya Gyan Vignan Samithi Star Party, Hasan, Karnataka (15 Feb)*
* K Nagaraju: *Astronomy Observing Techniques, Siddaganga College, Tumkur, Karnataka (16 Feb)*
* Prajval Shastri: ಆಕಾಶಗಂಗೆ, *"Milky way"*, in Kannada, *Madivaala High School, Bangalore (16 Feb)*
* S Chatterjee: *Revolutionaries in Science: Galileo and Darwin, Association for India's Development, Bangalore (22 Feb)*
* Margarita Safonova: *Astronomy, Why is it Useful?, Kendriya Vidyalaya, IISc, Bangalore (27 Feb)*
* S Chatterjee: *A Journey into our Galaxy, Kendriya Vidyalaya, IISc, Bangalore (27 Feb)*
* K B Ramesh: *Chandrayaan-1 - A Journey to the Moon, Christ Academy School, Bangalore (27 Feb)*
* K B Ramesh: *The Sun-Earth Relationship, Christ Academy School, Bangalore (27 Feb)*
* Siraj Hasan: *New insights into the Mysteries of the Sun, Karnataka State Council for Science and Technology (27 Feb)*
* Siraj Hasan: *New Developments in Understanding our nearest Star - The Sun, DST, INSA and IIT, Delhi (28 Feb)*
* S Chatterjee: *How Thick is our Galaxy?, NMKRV College, Bangalore (28 Feb)*
* D Angchuk: *Indian Astronomical Observatory: Astronomy at High Altitudes and its Future, Defence Institute for High Altitude Research, Leh (28 Feb)*
* K Sundara Raman: *Solar Physics at Kodaikanal Observatory, Rev. Jacob Memorial Christian College, Ambilikkai, Dindigul Dist. (28 Feb)*
* C Sivaram: *Astrobiology*, St. Joseph's College (28 Feb)
* S Pukalenthi: வானவியல் அறிமுகமும் வான் காட்சியும், *"History of Astronomy & Sky Watching"*, in Tamil, *(VBO Science Day)*
* S Ramya: *The Mystery of Galaxies (IIA Science Day)*
* Aruna Goswami: *A Cosmic Journey: From Hydrogen to Iron and Beyond (IIA Science Day)*
* Edwin Ebenezer: *Sun with STEREO (IIA Science Day)*
* Ravinder Banyal: *Ancient Astronomy (IIA Science Day)*

At the venue of the ASI meeting held at the IIA Bangalore campus, IIA organised a digital photo exhibit showcasing astrophotography work by amateur astronomers from all over India. The exhibit was in the form of a running slide-show on a computer monitor in the lobby of the auditorium, and had about 70 beautiful photographs. With the permission of the contributors, this slide-show is also available on IIA's webpage.

(http://www.iiap.res.in/iya2009/slideshow)

As part of IIA's preparations to conducting outreach programmes, a sky-watching workshop was conducted at IIA Bangalore on the 4th February, 2009. C Muthumariappan, S Pukalenthi, K Kuppuswamy and K Jayakumar from VBO were the primary resource persons. A total of about 25 IIA staff as well as teachers from the Madivaala High School with whom IIA has an on-going extension programme, participated. Compilation of night-sky objects likely to be visible at different sky-background levels, sky-watching tips, FAQs during sky-watching programmes, etc. were discussed. There were also demos of Sun-watching, the box spectrograph and night-sky watching.

In celebrating astronomy in IYA09, IIA commissioned the Bangalore Little Theatre to produce a play called “Starry Messenger”, by Ira Hauptman, which was performed on the 19th February, 2009, on the occasion of the Meeting of the ASI which IIA hosted. It was the first performance of the play outside of the United States, and was in the auditorium of the St. Johns Medical College, near IIA. The play was attended by the delegates of the ASI, as well as IIA staff, families and friends.

The play takes a surreal look at the life of Galileo Galilei through the lens of retrospection. Cardinals of the Catholic Church, who, during their lifetimes, hounded and threatened to kill Galileo for his heretic claims, catch up with him in the after life. The cardinals attempt to investigate the sincerity with which Galileo had recanted. They morph into characters that were the largest influences in Galileo's life, namely, his daughters, son and most ardent pupil, and in so doing, attempt to make him relive the many stages that led to the final moment of his recantation. As hard-nosed as the Cardinals were, there were also those among them who were sympathetic towards the great scientist. Those sympathies too follow in the afterlife. It was history being told as a tale.

The playwright Ira Hauptman is a Professor of theater studies at Queens College, City University of New York, USA. The play, which was a part of BLT's History of Ideas project, was directed by Anand Ramprasad, and mentored by Vijay Padaki. It had Deepak Srinivasan, Romal M Singh, Kanchan Bhattacharyya, Shwetha Jairam and Shree Lakshmi J Rao in the caste. The production was managed by Priyalakshmi Rao and design and execution of lights were by Pritham Kumar.

This year, Science Day at IIA, Bangalore, began with an Astronomy Painting Competition for the children of Madivaala High School, with whom IIA has been running an extension programme for just over a year. About eighty enthusiastic children turned out delightful paintings that depicted the sky, telescopes, rockets and Galileo.

A total of 250 students split into two batches listened to talks on galaxies, synthesis of the elements, the Sun, and ancient astronomy. There was also a Sun viewing session. A special feature of Science Day was presentations on astronomy by the students. The children from Madivaala school gave remarkable presentations in Kannada on star formation, constellations and an overview of astrophysics. There was a sky-watching session after dusk, for students who chose to stay with their parents, IIA staff, families and friends. The session was lead by S Pukalenthi. The 6" and 14" telescopes were used, with Venus, Moon and Saturn being prime targets, in addition to several double stars.

Science Day at VBO had about 700 people visiting, including students and teachers from the Rajiv Gandhi College of Engineering (Chennai), MI Teachers Training institute (Tiruppattur), PUE school (Jordanpatti) and Social Welfare Home (Selam) and also other members of the public. The visitors had a tour of the observatory facilities conducted by C Velu and N Dinakaran. About 500 of the visitors stayed for the night-sky watching programme lead by K Kuppuswamy.

On the occasion of IYA2009, R C Kapoor and T K Murali Das organized an astronomy exhibition stall as a part of a 'Pride of India' Exhibition arranged by the Department of Science & Technology at the beautiful campus of the North Eastern Hill University (NEHU), Shillong in Meghalaya, coinciding with the 96th Indian Science Congress, during Jan 3-7, 2009.

School students with R C Kapoor at the IIA stall

The exhibits in the stall depicted interesting astrophysical phenomena and also showcased the astronomy facilities of IIA at its various campuses. There was also a continuous play of two documentaries, one on IIA, and a second titled 'Cosmic Collisions'. The stall was visited by a large number of people including members of parliament, the Vice-Chancellor of NEHU, scientists, school and college students and the general public, and the exhibits were very well received.

- R C Kapoor

REAP Students at VBO

The Research Education Advancement Programme students from the Bangalore Planetarium visited the Vainu Bappu Observatory on the 28th January 2009. A report by amateur astronomer Amar Sharma:

This was my 6th visit to the observatory, a place that I have always revered and worshipped. I accompanied seven REAP students from the planetarium to spend a night imaging Messier objects and comets with the 40-inch telescope.

By 5pm preparations were on for an on-going observation of a variable star. Telescope operators Mr. Kuppuswamy (co-discoverer of Uranus' rings) and Mr. Muniraj poured liquid Nitrogen into the 1K x 1K CCD dewar and got busy taking 'skyflat', 'bias frames' and other CCD pre-requisites under still hazy skies. At sunset, we witnessed an exquisite sunlight colour against the cloudy sky, in the backdrop of the distant 2.3-metre dome.

The density of stars was EXCEPTIONAL!! Post mid-night the Milky-Way in Carina was extremely broad and dense. M33 was visible to the naked-eye with averted vision. However, over the past three decades, local lights have taken a toll on the dark sky in some directions.

After showing everyone the basic binocular targets, I moved on to 10x50 limit-testing (hand-holding them). I could see Comet 144/P Kushida quite easily close to Gamma Taurus, as a fuzzy circular spot. NGC 253 (Sculptor galaxy) was visible through the haze, along with it's neighboring globular, NGC 288. I was glad to spot a 9.6 mag barred-spiral galaxy in Fornax, NGC 1365. At midnight, I could easily spot M97 (the Owl Nebula!!). M51 (Whirlpool galaxy) with it's companion NGC 5195 also were easily visible as two detached objects! Since the conditions were inviting, I ventured into the Virgo cluster. M100 was easy, and I could spot M84 and M86 (conditions were indeed very good!). I also saw globulars M68, NGC 5286, NGC 6144 and galaxies M83, Sombrero, Centaurus A and an open cluster NGC 4103 in Crux.

By 2 am the dome was closed because of humidity, But at 3 am, Mr. Muniraj told me that we could start imaging! The skies were crisp and clear until pre-dawn, with fog only at the horizons. We imaged comet 29/P Schwassmann-Wachmann-1 and Comet and Comet Lulin. We all saw comet Lulin in both the finder scopes as a big hazy mottled patch, like M13 or M22. Two exposures each in B, V and R filters were taken. The dead of the night was broken by our synchronous cry of joy when we saw our image of the comet and its bright coma!

We are waiting to process these images at the earliest, and see what they hold in store for us. It will be a trip to remember always…

- Amar Sharma, Bangalore Astronomical Society

Award of PhD

Congratulations to Dr. M. Sampoorna, who was awarded the Doctor of Philiosphy (Ph.D.) degree in Physics by the Indian Institute of Science (IISc), Bangalore in December 2008 for her thesis work titled 'Polarized line formation in turbulent and scattering media'. She carried out her Ph.D. work under the supervision of K. N. Nagendra at IIA during 2004 - 2008, under the Joint Astronomy Programme of the Department of Physics, IISc.

Sampoorna's productive doctoral thesis work has focussed on two specialized front-line topics of current interest in the area of Solar Physics, namely the theory of polarized light scattering and spectro-polarimetry. She plans to take up a post-doctoral position at the Instituto de Astrof'isica de Canarias, La Laguna, Tenerife, Spain, from April 2009 and her research would focus on 'Observations and modeling of the Second Solar Spectrum'. We wish her all the best and a productive career!.

New Appointments

Welcome to B. Ravindra and C. Kathiravan, who have joined the academic staff of the Institute. Ravindra joined in November, 2008 and Kathiravan in January, 2009. Both are solar physicists by training.

Ravindra does research on active region dynamics and on techniques to measure the velocity field and helicity fluxes from observations. He did his Ph.D. at the Udaipur Solar Observatory (PRL). Before taking up his new position at IIA, Ravindra was a post-doctoral fellow at the Department of Physics, Montana State University, USA.

Kathiravan does research in the field of solar radio astronomy and instrumentation to observe various radio outbursts, flares and coronal mass ejections. Kathiravan continues on his work at IIA, where he finished his Ph.D. (March 2006) followed on by a post-doctoral tenure.

Obituary

It was a tragic loss for IIA when G Thirumurthy, who was a Lab Assistant at the Bangalore Campus, suddenly passed away on the 4th January, 2009. He was 53. A dedicated and ever-smiling member of the IIA staff, he worked for IIA for 26 years. Thirumurthy is survived by his spouse Neela, and children Sridhar and Shasidhara. He will be sadly missed.

Retired

R. Srinivasan, Senior Professor, retired from IIA on the 31st of January, 2009. He worked for IIA for a total of 24 years. He headed the Electronics Division, and also served IIA in various other capacities, including Dean of the Faculty of Engineering Sciences and officiating Director.

N. Selvavinayagam, Civil Engineer, retired from IIA on the 31st January, 2009.

C. Sivaram has received the 'Vocational Excellence Award from the Rotary Club, Bangalore South.

Siraj Hasan has been appointed President of the Oxford and Cambridge Society of Bangalore and the Alexander von Humboldt Foundation of Bangalore, and also as Adjunct Distinguished Professor at the Centre for Astroparticle Physics, Saha Institute, Kolkata.

Chandrasekhar Post-Doctoral Fellowships

The Director, IIA invites applications from exceptionally bright candidates with outstanding academic credentials for the award of 'Chandrasekhar Post-Doctoral Fellowships' in all areas of astrophysics. Applications are accepted at any time of year. The fellowship is for an initial period of two years, extendable to three, with a minimum monthly stipend of Rs.25,000/-, an annual contingency grant of Rs.1,00,000/-, housing and medical benefits, and support for travel to Bangalore. More details are at http://www.iiap.res.in/postdoc.htm.

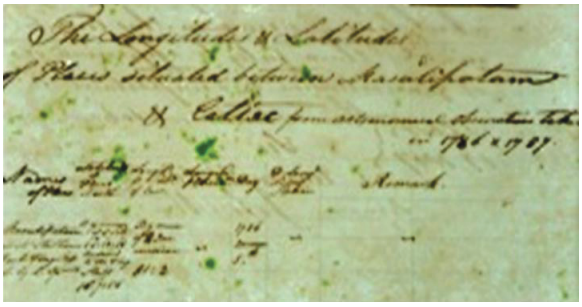
From the IIA Archives

Michael Topping and the Origin of the Madras Observatory

East India Company's Astronomer and Surveyor, Michael Topping made a major contribution to astronomy in India by establishing the Madras observatory during his short career of eleven years (1785-1796). Topping arrived in Madras in 1785 after making some astronomical observations at Maldives and the coast of Ceylon. He journeyed to Calcutta from Masulipatnam by land, and fixed the positions of important places on the way. The log book of his return journey by sea in the Company ship 'Walpole' contains details of the effects of currents on the ship's course in the Bay of Bengal, which laid the foundation for the theory of currents in the Indian Seas. In 1788, Topping surveyed the Coromandel Coast, by a series of triangles starting from Madras, and going up to Masulipatnam, using Hadley's sextant made by Stancliffe.

Masulipatnam Fort and environs during Topping's time

He claimed that the mean of his astronomical observations for the latitudes, did not differ more than a few seconds from those given by geometrical mensuration. He walked large distances braving hot climes to make his measurements. In August 1789, he conducted a survey of Bay of Coringa and the mouth of river Godavari. Topping used William Petrie's private observatory in Madras to make observations of Jupiter's satellites, which complemented his field observations in determining longitudes and latitudes. He argued that astronomy was the reason for the East India Company's prosperity as a mercantile power and they should therefore promote pure sciences like astronomy (his letter 27th Jan 1789, PC Vol. cliii). He prevailed over the opposition of the Chief Engineer, Major Maule, and had his plans for a new observatory implemented. This observatory was built on the banks of the river Cooum in Nungambakkam.The building had a conical granite pillar weighing more than 10 tons four feet in diameter at the base tapering to two feet at its height of 18 feet. On this was mounted a 12 inch alt-azimuth by Troughton.



First observation made at the observatory, fixing the longitude and lattitude of Masulipatnam

H. S. E. Integer et Urbanus, cui summæ fuerunt animi dotes, quas ad extremum fovit, machinarum mirus artifex, necnon in literis humanioribus ac musicis versatus, Michael Topping, Mathematicus admodum solers. Ingenii multa quidem pignora posteris reliquit et missus in has regiones astronomiam excolere, Societatis mercatorum sumptibus speculum sideralem juxta Sancti Georgii arcem formavit et posuit. Officio functo, promittens majora, occubuit febri, Januarii 7 A. D. 1796, Aet 48.

The epitaph of Topping's tomb which translates as: Here is buried, a gentleman of integrity and culture with tremendous gifts of the soul which he had cultivated extremely well. He was a wonderful engineer who was well versed in humanities and music. Michael Topping, the mathematician, has left for posterity many examples of his genius. He was sent to these regions to develop astronomy. Thanks to the merchants of the society he built and developed an observatory for stars near Fort St. George. While still in office and promising much more, he died of fever on Jan. 7, 1796 at the age of 48.

In 1791, during the British campaign against Tipu Sultan, Topping was engaged in the construction of gun carriages. Under the Madras Presidency, he established a Survey School with twelve students, which was one of the earliest technical schools outside Europe, and later transformed into the present-day Guindy College of Engineering. Topping got involved with repairing and expanding of the irrigation channels. He did a commendable work but unfortunately died in 1796 before finishing the task and reservoir networks.

Map of Madras

- Vagiswari, A., N. Kameswara Rao, Christina Birdie and Priya Thakur

Editors: Prajval Shastri and S. P. Rajaguru
Editorial Assistance: Suchitra K.
Photo Credits: T. K. Muralidas, S. P. Rajaguru & V. S. Shyam

Indian Institute of Astrophysics
II Block, Koramangala, Bangalore 560 034, INDIA
Tel : 91 (80) 2553 0672 Fax : 91 (80) 2553 4043
Voicemail : 91 (80) 2553 9250 E-Mail : newslet@iiap.res.in