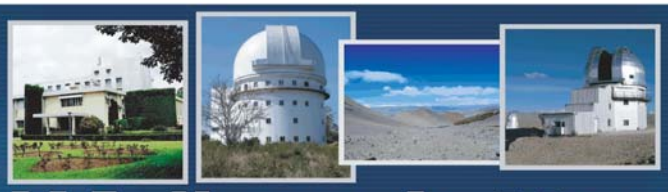

IIA Newsletter

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In this issue...

First Kodai-Trieste Workshop on Plasma Astrophysics

The first Kodai-Trieste Workshop on Plasma Astrophysics was held in Kodaikanal during August 27 - September 7, 2007. It was jointly organised by the Indian Institute of Astrophysics, Bangalore and the International Centre for Theoretical Physics, Trieste. The Workshop began in the pristine precincts of the Kodaikanal Observatory with a welcome message from the IIA Director, Prof. S. S. Hasan, read by Prof. Vinod Krishan, Director of the Workshop. In her opening remarks, Prof. Krishan also recounted briefly the glorious past of the observatory.

It is well established and appreciated by now that more than 99% of the baryonic matter in the universe is in the plasma state. Most astrophysical systems may be approximated as conducting fluids in a gravitational field. It is the combined effect of these two that gives rise to the mind-boggling variety of configurations in the form of filaments, loops, jets and arches. The plasma structures that cannot last more than a second or less in a laboratory remain intact on astronomical time and spatial scales in an astrophysical setting. The case in point is the well known extragalactic jets whose collimation and stability have remained an enigma in spite of the efforts of many workers in the field for several years. The high energy radiation sources such as the active galactic nuclei again summon the coherent plasma radiation processes for their exceptionally large output from regions of relatively small physical sizes. The generation of magnetic field, anomalous transport of angular momentum with decisive bearing on star formation processes, the ubiquitous MHD turbulence under conditions unreproducible in terrestrial laboratories are some of the generic issues still awaiting a concerted effort for their understanding. Quantum plasmas, pair plasmas and pair-ion plasmas exist under extreme conditions in planetary interiors and in exotic stars.

The Workshop was designed to provide a strong conceptual foundation of the subject of Plasma Astrophysics to young researchers and stimulate them to start research activities in this field.

The scientific programme kicked off with a two-day long session on Turbulence in which Joseph Niemela (ICTP, Trieste) delivered a couple of expert talks on hydrodynamical turbulence in classical and quantum fluids and Rayleigh Benard convection at very high Rayleigh numbers. Melvyn Goldstein (NASA/GSFC, USA) spoke on turbulence and global properties of the solar wind and efforts to simulate solar wind turbulence. P. K. Manoharan (RAC, Udhagamandalam) talked about solar wind turbulence and scintillation studies. Vinod Krishan described the modeling of spectral energy distributions in the solar wind through Hall-MHD. S. Sridhar (RRI, Bangalore) discussed Plasma and MHD turbulence in the interstellar medium.

The next two days were spent on the discussion of Astrophysical Dynamos. A. R. Choudhuri (IISc, Bangalore) spoke on dynamo processes in the astrophysical universe and the flux transport dynamo in the sun leading to predictions of the intensity of solar cycles. V. K. Gaur (IIA) deliberated on the geodynamo. A. Mangalam (IIA) described the constraints on dynamo action. Vinod Krishan introduced the kinematic dynamo in partially ionized plasmas such as those that exist on the solar surface, in star forming regions and accretion disks. J. L. Han (NAOC, China) reviewed the galactic dynamos.

Pulsars formed the subject of discussion in the following two days. J. L. Han introduced the subject and discussed pulsars as probes. A. A. Deshpande (RRI, Bangalore) described the individual pulses and pulsar evolution. R. T. Gangadhara (IIA) discussed in depth the radio pulsar emission geometry and possible radiation processes. G. J. Qiao (Peking University, China) described the comparative characteristics of high energy pulsars and particle acceleration and radiation in magnetospheres.

In the next session on accretion disks, Vinod Krishan revisited the magnetorotational instability in accretion disks and emphasised the lack of rigour in its treatment. B. P. Pandey (Macquarie University, Sydney) discussed the dynamics of magnetised accretion disks and the role of the Hall-MHD. P. Subramanian (IIA) spoke on hybrid viscosity and the magnetoviscous instability. B. Mukhopadhyay (IISc, Bangalore) discussed the transonic properties of accretion disks around compact objects.

P. K. Shukla (Ruhr University, Bochum) described the collective processes in very dense plasmas and complex plasmas (Quantum Plasmas). G. Thejappa (Univ. Maryland, USA) discussed interplanetary radio bursts and low frequency waves observed by the lunar prospector above the dayside surface of the moon. G. Lakhina (IIG, Mumbai) presented an evening talk on magnetospheric substorms and geomagnetic storms. The participants also presented seminars on their recent research.

The Workshop made for an enthralling experience both pedagogically, and in terms of the coming together of plasma astrophysicists and young researchers. It was a success on all accounts. The participants left hoping for more such workshops in the future.

The Workshop's International Advisory Committee consisted of D. O. Gomez (Argentina), J. L. Han (China), P. K. Kaw (India), G. Murtaza (Pakistan), R. Opher (Brazil) and A. Rogawa (Belgium). The organisational success of the Workshop was due to the hard and diligent team work of the organising committee, that included S. S. Hasan, Vinod Krishan, Joseph Niemela, J. L. Han, R. T. Gangadhara and K. E. Rangarajan. Special mention must be made of the administrative and other logistical supports provided by Sundara Raman, S. B. Ramesh, K. Sutherson, J. V. S. V. Rao and other members of the Kodaikanal Observatory.

This Workshop was the first in an intended series, which hopes to bring plasma physicists, astrophysicists and plasma astrophysicists together to first get acquainted with the systems and the issues. In subsequent workshops a subset of the topics would be selected for deeper and more technical deliberations. K. E. Rangarajan was the convener, and R. T. Gangadhara, the coordinator. To know more about the workshop, one can visit http://www.iiap.res.in/kt1/.

– R. T. Gangadhara

Corrigendum

The Editors regret that in the September 2007 issue of IIA Newsletter, under the contribution *'Parametrization of Stars using Medium Resolution Spectra',* names of two authors, *S. Muneer and Aruna Goswami*, were inadvertently left out.

Outburst of Comet 17P/Holmes

Comet 17P/Holmes had a massive outburst around 24.07 October, 2007. The comet brightened from a normal magnitude of 17.8 to 3.5 on October 24.55 (IAUC 8886).

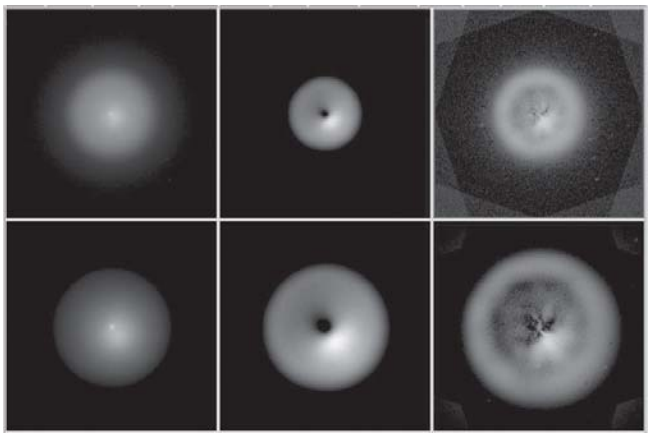

Figure 1

The comet was observed in the Z band at HCT on 25 and 26 October. Figure 1 shows the images obtained on these two days. The top and bottom left panels show the original processed images of 25 and 26 October respectively. North is to the top and East is to the left. The ejected debris is clearly seen in the south-westerly direction. The outburst plume and the envelope are seen more clearly in the middle panels after the contribution of the 1/r coma is removed by division by a synthetic coma in which the intensity at a projected distance "r" from the comet centre falls off as 1/r. Further details can be delineated by applying a digital filter using the "Shift-Rotation" algorithm. This filter brings out details of the edges of the ejecta where the intensity gradient is maximum. The edges of the expanding plume and a central collimated beam are seen. The shell structure in these processed images should be interpreted as the edge of the expanding envelope and is not a real feature.

The features on the two days appear alike except for expansion with a projected velocity of 0.4 - 0.45 km/s. The total image field is 3.55 X 10^5 km. The heliocentric and geocentric distances of the comet are 2.44 AU and 1.63 AU respectively.

Modeling of the dust features in these images and on subsequent days will be carried out to investigate the outburst activity, grain properties and the ejection velocities.

– R. Vasundhara, K. Sasikumar Raja, P. Ramya, S. Muneer, Ravindra Pawase, Aman Preet Kaur, Manjunath Hegde.

The 2006 outburst of the recurrent nova RS Ophiuchi

The recurrent nova RS Ophiuchi had its sixth recorded outburst on 2006 February 12. The previous recorded outbursts were in 1898, 1933, 1958, 1967 and 1985.

Recurrent novae are cataclysmic binary systems that have more than one recorded observations of a nova outburst. The outbursts are powered by thermonuclear runaway reactions on the white dwarf surface following accretion of mass from the companion. The recurrence periods of the outbursts range from 10 - 100 years. The white dwarf in these systems are believed to be massive, accreting at rates 10^{-8} - 10^{-7} $M_\odot$ per yr. In order to explain the observed recurrence rates and outburst light curves, the theoretical models require the white dwarf to be hot and its mass close to the Chandrasekhar limit in most systems. The number of known recurrent novae now stands at ten, of which nine are Galactic, and one is extragalactic having occurred in the Large Magellanic Cloud. The interacting binary system of RS Oph comprises an M giant and a hot accreting white dwarf with an orbital period of 455 days. There is remarkable similarity between the optical light curves and spectra from different outbursts. The 1985 outburst of RS Oph was one of the best studied events, with the outburst recorded from x-rays to radio wavelengths. The radio and x-ray observations clearly indicated interaction of the nova ejecta with pre-existing circumstellar material formed by the wind of the giant companion. These observations ratified the explanation for the presence of coronal lines in the optical as arising in a region heated to coronal temperatures due to shock interaction of the nova ejecta with the red giant wind material.

The 2006 outburst of RS Oph was subjected to intense monitoring in all wavebands, almost immediately after discovery. The radio emission was detected at frequencies greater than 1.4 GHz as early as approximately 5 days from the outburst in contrast to an implied turn-on around day 14 during the 1985 outburst. The radio source of RS Oph was resolved by VLBI and the images on day 14 during the 2006 outburst show an asymmetric structure, which is explained by O'Brien et al. (2006) as being due to foreground absorption.

Intense monitoring of the outburst in the optical, using HCT and VBT began one day after the discovery. The evolution of the optical spectrum was very similar to that observed during the 1985 outburst. The outburst was also monitored with GMRT at 610, 325, 240 and 150 MHz between days 18 – 351. Based on these observations, Kantharia et al. (2007) report the first ever detection of the nova outburst at low radio frequencies. It is interesting to note that no radio emission was detected at 327 MHz during the 1985 outburst

(Spoelstra et al.1987). The radio light curves (Figure 1) indicate a steep rise in the flux density, followed by a relatively flat maximum and a subsequent decay. Different frequencies seem to become visible and peak at different epochs with the lower frequencies turning on at later times. The post-maximum decay at all the frequencies is fairly similar. The observed spectral index ($S \propto \upsilon^{\alpha}$) varies from $\alpha \sim -0.1$ around maximum to $\alpha \sim -1.0$ around day 220. These observations clearly show that the radio emission at these frequencies is nonthermal. Although the nonthermal nature of the radio emission was inferred from the brightness temperatures and comparison between radio and x-ray flux (Taylor et al. 1987, Bode et al. 2006, O'Brien et al. 2006), for the first time the nonthermal nature of the low frequency radio emission is clearly demonstrated by the negative spectral index.

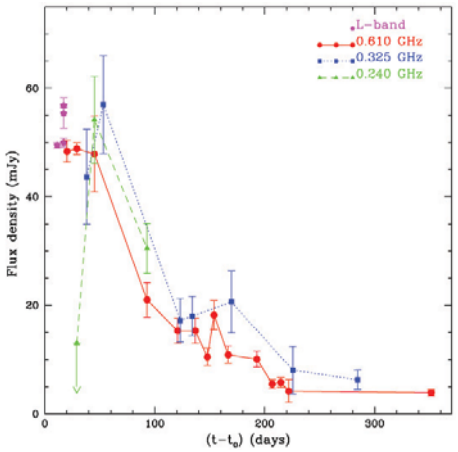

Figure 1

The 2006 radio observations suggest that a steep-spectrum synchrotron source became visible at the lower frequencies during the current outburst due to a reduced foreground absorption of nearly 30% compared to the 1985 outburst.

Kantharia et al. model the observed light curves adopting the models for radio supernovae, wherein the relativistic electrons and enhanced magnetic fields necessary for synchrotron emission are generated due to the shock interaction of the nova ejecta with the circumbinary red giant wind material that is ionized and heated by the nova explosion. The radio emission rises rapidly as the shock progressively overtakes the wind material, causing a decrease in the line-of-sight absorption. The light curves at the low frequencies are well explained by decreasing free-free absorption by the foreground CSM of the synchrotron emission from the remnant of the nova outburst. Model light curves with a spectral index of $\alpha = -0.8$, decay power law of index $\beta = -1.2$ and optical depth due to a homogeneous, clumpy absorbing medium well fit the observed light curves. A clumpy medium seems to dominate the absorption at early times. The light curves indicate the appearance of emission components consistent with the VLBA, EVN and MERLIN images at higher frequencies.

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Kantharia, N., Anupama, G. C., Prabhu, T. P., Ramya, S., Bode, M. F., Eyres, S. P. S., O'Brien, T.J., 2007, ApJ, 667, L171.
O'Brien, T. J., et al. 2006, Nature, 442, 279.
Spoelstra, T. A. T., Taylor, A. R., Pooley, G. G., Evans, A., & Albinson, J. S. 1987, MNRAS, 224, 791.
Taylor, A. R., Davis, R. J., Porcas, R. W., & Bode, M. F. 1989, MNRAS, 237, 81.

– G. C. Anupama and N. G. Kantharia

First analysis of the 24 month atmospheric time series continuously measured CO_2 concentration at IAO, Hanle

Atmospheric CO_2 concentrations have been continuously measured at the site of the Indian Astronomical Observatory in Hanle (Figure 1 & 2) since the CARIBOU – an ultra-high precision CO_2 analyzer (< 100 ppb), became operational in August 2005. The Caribou consists of an infrared ($\lambda = 4.3$ μm) analyzer unit with micro-processor controlled, thermally stabilized LICOR-6252 pressure/temperature/flow regulators, a pumping unit with a cold (–60° C) drying trap and a calibrating unit.

Figure 1
The map on the left shows the location of the Indian Astronomical Observatory at Hanle as well as the locations of the flask stations at Pondicherry and Cape Rama. On the right is the CARIBOU building.

Figure 2

A perspective view of the Hanle Observatory and the air drawing pipe over the roof of the CARIBOU building (Figure 1) a little right of the middle.

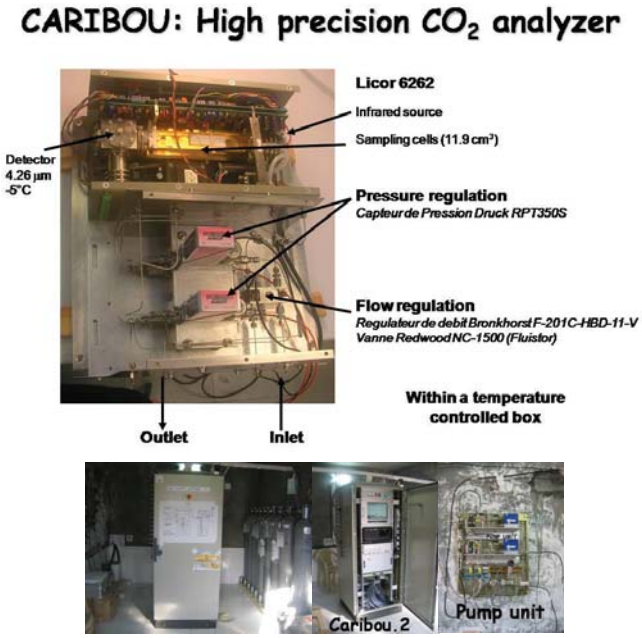


Figure 3

Figure 3 shows CARIBOU and the regulating units.

The calibration is performed every 8 days using 6 gases with a concentration range of 340 – 450 ppm. Each gas is analyzed for 10 minutes and for 8 pyramids. To correct the instrument drift a reference gas is injected for 10 minutes/hour. A target gas is also injected for 50 minutes every 7 hours to control the quality. Wholly powered by solar cells, it is the highest altitude CO_2 measuring station of the globe, situated in a cold desert like environment with no local sources of carbon from biota or industries. The typical CO_2 diurnal cycle is characterized by an amplitude of about 0.5 ppm (Figure 5). It is maximum in winter and autumn with highest CO_2 concentration observed during the afternoon, corresponding to a period of strong increase in the wind speed from 2-3 metre/sec. In summer the CO_2 diurnal cycle presents the first plateau in the afternoon and a highest one between 8 p.m. and midnight.

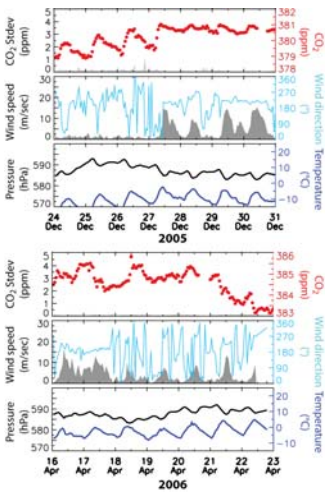


Figure 4 shows typical hourly measurements over a one-week period.

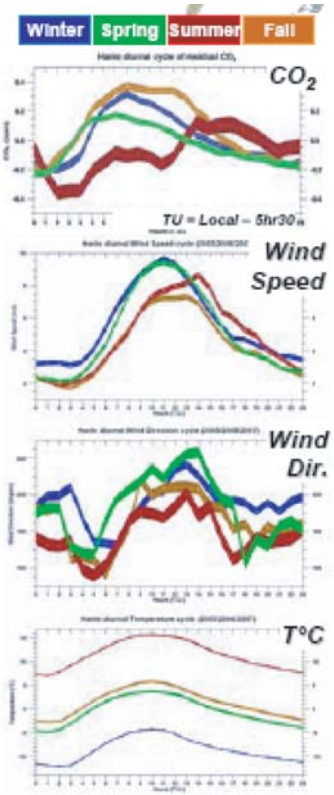


Figure 5 shows the diurnal cycles of CO_2 residuals, wind speed and direction and temperature averaged for the 4 seasons over the period 2005-07

Since there are no high precision trace gas monitoring stations currently operational anywhere in North India or Central Asia, we compare the Hanle results with existing values of CO_2, CH_4 and CO measurements of weekly collected air samples at Cape Rama on the Indian west coast and Mt Waliguan in China, respectively measured at the laboratories of CSIRO and ESRL. The in-situ CO_2 measurements at Hanle show a shift of about one month in the spring draw-down. The CH_4 and CO concentrations at the coastal site of Cape Rama are significantly higher than those at the other two stations, showing a seasonal cycle with an amplitude of ~150 ppb. These gradients are explicable by the seasonally varying wind systems of the Indian monsoons. The truncation of the CO_2 minimum at Cape Rama is caused by the southern hemisphere air masses low in the biospheric signal, whilst the air sampled at Hanle has flown over India inducing a maximum level of CH_4 concentration in September. In winter the circulation pattern is reversed showing maximum levels of CH_4 and CO at Cape Rama swept from regional Indian emissions.

With the meteorology of the Hanle station reasonably well established as briefly indicated above, the Hanle CO_2 data is now being inverted for estimating the spatio-temporal Carbon fluxes over the Indian continent and Central Asia, which is the basic objective of this programme.

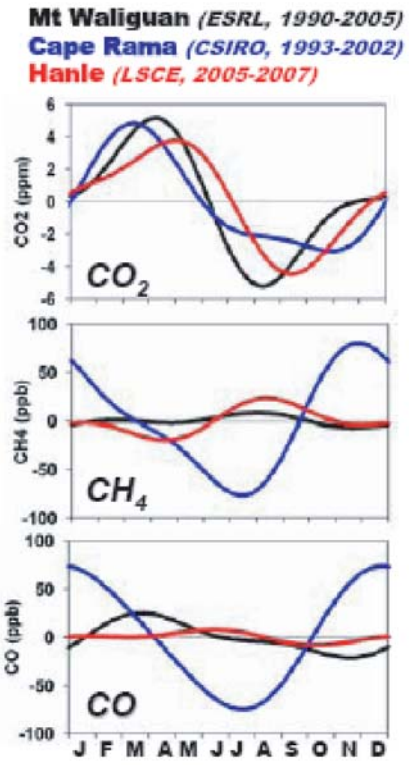


Figure 6 showing the seasonal cycle of CO_2, CH_4 and CO estimated from measurements at Mt Waliguan, Cape Rama and Hanle

This work was initiated in 2003 jointly with C-MMACS, Bangalore and Laboratoire des Sciences du Climat at de l'Environment (LSCE/ CNRS), France and partly supported by the Indo-French Centre, New Delhi. Meanwhile, a joint project has also been implemented collaboratively with Pondicherry University to generate data on the concentration of atmospheric Greenhouse Gases at Pondicherry to better constrain the inverted flux estimates, particularly over the Bay of Bengal.

- B. C. Bhatt, Dorje Angchuck, S. Gorka, V. K. Gaur (IIA),
- N. K. Indira, P. S. Swathi (C-MMACS, Bangalore)
- M. Ramonet, B. Wastine and A. Royer (LSCE / CNRS, France)

K. R. Subramanian, Professor, retired from service on October 31, 2007 on attaining the age of superannuation. Professor Subramanian is continuing as a Visiting Professor.

Professor K. D. Abhyankar (1928 - 2007) - a personal appreciation

Professor K.D.Abhyankar was a great astronomer, a great teacher and a great human being. He was my teacher and remained so all through his life. If one were to identify one quality that would characterise him, it would be his devotion to astronomy of all kinds. It was not a mere liking for the subject, his whole being existed for service to astronomy and as a corollary, for service to Indian astronomy. It was never a nine to five activity for him. He believed if astronomy were worth doing at all, it was worth everything that the individual could bring to it. When I was a fresh and clumsy student, he advised me 'you should do things in such a way that there would hardly be anything left for others to do' - a very hard task indeed but then, he adhered to it.

His scientific and organizational contributions have been described by various people. He himself described his experiences in an article published in BASI ('My encounter with astronomy' (1990), 18, 109-117) as part of the proceedings of an international workshop dedicated to him on the occasion of his retirement from Osmania University. I shall not repeat his biographical details and describe the honours he won, nor the books he wrote. Instead my account will be more of a personal nature. Abhyankar's astronomical career started at Kodaikanal where he joined as a research fellow in 1952 and got the taste of astronomical research. Once he caught the bug, he was afflicted with it for life. His aspiration to do a Ph.D in astronomy took him to the University of California at Berkeley. Even as a young graduate student at Berkeley, he visualised his future career as one working in astronomy, preferably the area of observational astronomy, and teaching and promoting it in India. He even chose his thesis topic accordingly: observations of high mass, early-type, close binary systems. He worked with Otto Struve, who was not only an authority in that area (among other things) but was a legend in his own life time. Struve mentions with admiration Abhyankar's thesis work in one of his books - 'Astronomy of the twentieth century', a classic in the field. It was not the lack of opportunity elsewhere that brought him back to India, it was the desire to develop modern astronomy in India that made him return. Thus he became a symbol

for his students to emulate. In fact when he moved to Osmania after a short stint at Kodaikanal, he hardly had any instruments to pursue observational astronomy. He then turned to theoretical research on line profiles in expanding atmospheres. Many others have described his significant contributions to the theory of stellar atmospheres, particularly the scattering medium (See, for example, A. Peraiah, (1990) BASI 18, 119-136). Abhyankar himself highlighted his efforts in this direction, in the INSA Vainu Bappu Medal Lecture. The admirable aspect was his flexibilty. If some favourite venue in astronomy were blocked for some reason, he could find another equally rewarding one to pursue. I have this feeling that he would have achieved much more as a researcher, had he been in any other place with better facilities and a more conducive research atmosphere than what he had. He even said that his class fellows at Berkeley proved to be better astronomers than himself. I had the opportunity of meeting a few of his class fellows of that time. One of them recalled Abhyankar's encounters with Kurganoff (a radiative transfer pundit who was teaching a course then at Berekley) with admiration. Abhyankar loved teaching. His lectures were always lucid with clarity of concepts and used to bring out how the subject developed. He initiated me and many other students e.g., R. Rajamohan, M. Parthasarathy, into observational astronomy. It was such a great fun observing at the Nizamiah Observatory with the venerable old 15-inch refractor using a photometer (built by MBK Sarma) having a 1P21 cell and following the variations of the beta Cephei star Nu Eridani, a star that was studied earlier spectroscopically by Struve and Abhyankar. It took no less than 4 people to make an observation: one had to be at the focus end of this long refractor changing filters and giving exposures, a second individual sat near the polar axis clamping and unclamping the RA axis using ropes, a third one (usually Professor Abhyankar himself) near the chart recorder, and the fourth person had to stand in between, relaying instructions from Abhyankar, as it was impossible to hear each other in the noise created by the drive motor. I further continued observations of Nu Eridani at Naini Tal. Abhyankar later told me 'If you want to pursue observational astronomy, you should get trained in a good observational centre for astronomy' and encouraged me to go abroad. He even took the initiative of writing to Harlan Smith, the then director of the McDonald Observatory recommending my case. I finally chose Lick Observatory (where Abhyankar also worked as a student) and spent a few days with him and Mrs Abhyankar in Pasadena, on my way to Santa Cruz. Professor Abhyankar was spending his sabbatical at JPL then working on planetary atmospheres. I know of several people who benefited from similar encouragement from him. After a few years when I was thinking of coming back to India, he invited me to come to Osmania and work, but in spite of his best efforts Osmania University could not provide me with a job.

Professor Abhyankar came to be identified with the Astronomy Department of Osmania. The department became known as a centre for binary star research mainly through his efforts. He was a fountainhead of ideas. Almost every one at the Astronomy Department used to approach him for astronomical projects and guidance. During my short stint at Osmania, before I moved to IIA, he invited me to give a talk at my first ASI meeting at Kodaikanal with an implication that I should show spectra (recorded on a film) obtained with the Meinel Spectrograph mounted at the Nasmyth focus of the 48-inch telescope at Rangapur.

It is no exaggeration to say that he nurtured and brought up the Astronomical Society of India. He wrote its constitution, worked in various capacities as the Treasurer, the Secretary, the President, and even as the Editor of its Bulletin. He firmly resisted efforts when there was a campaign for a merger of BASI with another journal. He was of the view that BASI should retain its own identity. He was a very straightforward man who expected others to be so. His characteristic expression was 'why'. If there were a choice between gaining something by diplomacy and circumspection and losing it by applying blunt logic, he would not shy away from following the latter option. There were stories galore among his students how logical he could be. It was said that once a student while admiring something exclaimed 'terrific!' in front of him, pat came the question from Abhyankar 'is that terrifying you?'

In later years Abhyankar also got interested in ancient Indian astronomy and wrote several papers and monographs on Vedic calendars and astronomical significance of several festivals, e.g., Maha Sivaratri. He was a scholar proficient in Sanskrit as well and put it to good use in such pursuits. He used to encourage my amateur attempts in archeoastronomy as well. I always used to send my papers to him for scrutiny. His interaction with our institute was almost continuous in one form or other throughout his lifetime. Several of his students and associates have been members of our staff. He was also a member of our governing council for some time.

Even though in the last few years his mobility got restricted, his activities continued at the same pace as earlier. He was in demand for writing popular articles on astronomy in various journals. When I visited him last in January 2007, he said he was writing an article for the CSIR journal.

As students at Osmania we used to work hard to impress him. Even in later years we continued to work with the same aim although we never knew whether he got impressed or not. All these years I used to entertain this confidence that there is a master who could always correct my mistakes. It is not easy to get a replacement. We would feel Professor Abhyankar's absence for a long time to come.

- N. Kameswara Rao

National meeting on Infrared Astronomy

A national meeting on Infrared Astronomy was held in IIA on November 12 & 13, 2007. Earlier this year, the Joint Astronomy Centre, that operates the United Kingdom Infrared Telescope (UKIRT) facility in Hawaii, indicated that the UKIRT Board is planning to share the operational costs of running the facility with other institutions from the year 2010 against guaranteed observing time to the co-sharers, and approached IIA to seek a partnership for the above purpose. Astronomers in IIA were greatly excited at the prospect and it was decided by the Director, IIA that a discussion at the national level must take place before any firm proposal is made to the Government of India to seek funding for the purpose, since such a proposal needed to be supported by a strong science case. The meeting was organised to explore the Indian interest in infrared astronomy and to prepare a proposal with a scientific justification to approach the funding agencies.

The meeting was attended by the scientists and students of the Stellar and Galactic Astronomy Group of IIA and ten outstation participants representing the institutions - ARIES, IUCAA, PRL, TIFR and two universities. The primary aim was to discuss and collate the thrust science areas in infrared astronomy which are of interest to the Indian astronomical community. At the meeting, a keen interest in the UKIRT proposal was evinced by individuals and institutions, suggesting that there is a national interest in participating in this programme.

The scientific talks were held on the first day followed by a business meeting on November 13. All talks were well attended. The programme started with a welcome address by the Director, IIA. This was followed by a presentation by Annapurni Subramaniam on the available groundbased infrared facilities and their comparison with UKIRT. The talks were grouped under the following three sessions:

1. Star forming regions, clusters and sub-stellar objects,
2. Evolved stars and eruptive objects and
3. Galaxies and AGN.

There were 6 talks in session 1, 7 talks in session 2 and 4 talks in session 3.

A wide variety of scientific projects were presented in the above categories. This was a good indicator of the strong Indian interest in infrared astronomy. The topics presented in the meeting along with the interests from the participating institutes will be compiled to create a science case for the UKIRT funding proposal. This proposal will be submitted in due course to the Department of Science & Technology of the Government of India.

– Annapurni Subramaniam

National Symposium on Gamma Ray Astronomy

Gamma ray astronomy probes the cosmos at the highest energies. Gamma rays of lower energies (up to a few tens of GeV) are detected by satellite-based observatories, whereas in the higher energy range (Very High Energy (VHE), i.e. 100-10,000 GeV) they are detected using the ground-based Atmospheric Cerenkov Technique. The observations in these two energy regions have shown that a substantial number of the sources cease emission in the VHE domain. Thus it is highly likely that Photon Astronomy as we know it is finding its limit at these energies. Therefore, experiments in the energy region between that of the satellite observations and the Atmospheric Cerenkov Technique can catch the death knell of quite a few sources. Two such experiments have been undertaken at Hanle in Ladakh under the collaboration of IIA, TIFR and BARC: the High Altitude GAmma Ray (HAGAR) experiment which is in the commissioning stage and the Major Atmospheric Cerenkov Experiment (MACE), currently in the designing stage. Both use the fact that the number of Cerenkov photons by even lower energy gamma rays is considerable at very high altitudes.

The Indian Institute of Astrophysics hosted a two-day National Symposium on “Gamma ray Astronomy” at the Bangalore campus aimed at familiarizing the Indian astronomical community with ground-based Gamma ray astronomy, the experiments in India and to motivate young researchers into this field. The symposium was held on November 23 & 24, 2007 and had about 135 registered participants. Out of this about 40 % were from outside Bangalore. About 35 M.Sc and Ph.D students participated in the symposium.

On the morning of the first day, Prof S. S. Hasan welcomed the gathering and gave a general introduction to the efforts in the field. The conference was inaugurated by Prof S. M. Chitre, the well known astrophysicist and a member of the Governing Council of IIA, who traced the history of astronomy starting from the days of Galileo and culminating in the present experiments at different wavelengths. There were 18 thirty-minute talks in the symposium. The nine talks on

the first day were devoted mostly to various aspects of gamma-ray astronomy. The last few years have seen the discovery of very high energy gamma-ray emission from a variety of sources with major contributions from the HESS and the MAGIC experiments. The phenomenal progress in the field was stressed by several speakers. There were talks on the early Indian experiments at Ooty, Gulmarg, Pachmarhi and Mt Abu and the new experiments HAGAR and MACE at Hanle. The talks on the second day covered other aspects of High Energy Astrophysics like Cosmic Rays, X-ray Astronomy, Neutrino Astronomy, Supernovae, Gamma Ray Bursts, Gamma Ray Astronomy at Ultra high energies etc.

A discussion session at the end of the symposium stressed that (a) more multi wavelength efforts are necessary, (b) smaller experiments should choose niche areas to effectively contribute to the field. There were also discussions on how new efforts should be undertaken to interest young students in astronomy and astrophysics. Some of the suggestions included (a) visits of considerable duration by students to various laboratories and observatories, (b) improving the JRF selection process so as to give opportunities to more students. The meeting provided for a forum where seasoned practitioners of gamma-ray astronomy interacted closely with beginners in the field as well as with prospective entrants to it.

– P. R. Vishwanath

Public outreach programmes

Lady Doak College, Madurai sent their advanced science students to see the IIA facilities during their college field trip to Bangalore end of September. For convenience, Saturday, September 22, 2007 was chosen by the Public Outreach Committee for this visit. A daylong programme was organised for the visiting students at CREST, Hosakote.

There were a total of 25 students and two staff members from the College. The programme started with an illustrated powerpoint presentation on IIA facilities and IIA's activities by Professor G. C. Anupama. In the afternoon, the visitors gathered at the CREST auditorium to watch a live demonstration on a TV screen of the operations of the Himalayan Chandra Telescope at Hanle, transmitted via the dedicated satellite link. Mr Dorje Angchuk from Hanle gave the demonstration. This was followed by a question and answer session after which the visiting students were given a guided tour of the Laser Science Laboratory at CREST.

On September 26, children belonging to the Tamil Nadu based Nehru Children's Cultural Association visited IIA, Bangalore as part of their science field trip. Most of the students were high school children from Chennai. They were joined by a smaller group of pre-university students from Chidambaram. Close to 60 students came to IIA with the President of the organisation, Mr M. R. Sugumaran, leading them. Several senior scientists of IIA assisted the Public Outreach Committee to put up an enthralling programme consisting of a short film and two illustrated talks. The programme started with the screening of the movie 'From Nungambakkam to Hanle' which gives a brief history of IIA starting with its roots in the eighteenth century and ending with the establishment of the Indian Astronomical Observatory in Hanle in 2000.

This was followed by Professor Harish Bhatt's talk on 'Our Universe'. Prof. Bhatt introduced the children to the major constituents of the visible universe taking care to point out its immensities and describing in a lucid manner how these constituents – stars, nebulae and galaxies, form and evolve.

After a short break for snacks and beverages, the programme continued with Professor Jayant Murthy's talk 'Science from Space', which commemorated, a week in advance, 50 years of space exploration by man which had started with the launch of Sputnik I on October 4, 1957.

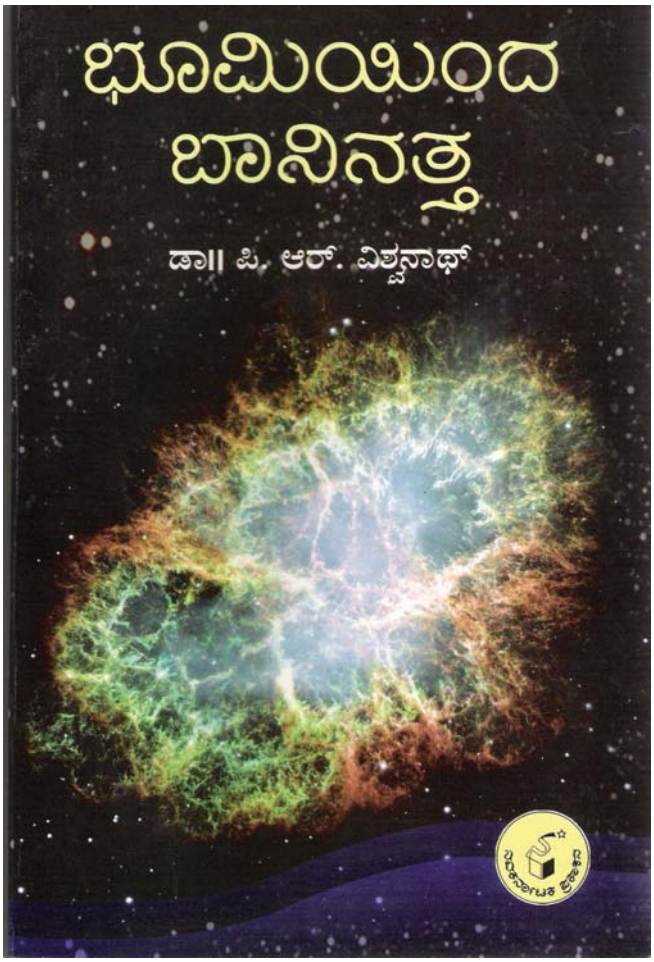
Although only a half hour slot at the end was designated for an open question and answer session, the students were sufficiently motivated by the talks to ask questions for much longer. It was amazing to see the interest that the young audience had in astronomy, their acute awareness of many astronomical phenomena and the breadth of their general knowledge. They kept all the participating IIA scientists engaged in arguments and answering questions for well over an hour and a half. The programme was over only late in the evening with the children promising that they would return perhaps a year later with more challenging questions.

Professor R C Kapoor recently conducted a small workshop with students from the Delhi Public School, Kanakapura Road, Bangalore. The school authorities had approached Professor Kapoor to explore if scientists in IIA could reply to some of the queries of a 5th class boy, Ashwin, on supernovae about which he had done a powerpoint programme as part of a project in their class.

Prof.Kapoor asked the school to bring along a group of 20-30 interested students along with Ashwin with his presentation and queries on supernovae. On Nov 28, 2007 a group of 20 DPS students belonging to classes 9 to 11 and Ashwin along with two physics teachers came to IIA. Ashwin gave a wonderful presentation on supernovae full of visuals - photographs of astronomical objects and artists' paintings relevant to the subject, accompanied by crisp but to-the-point explanatory notes. Professors Kapoor and Anupama spent over an hour with the students who asked questions ranging from the origin of the Solar System to that of the Universe, from string theories to UFOs. Supernovae, neutron stars and black holes dominated the discussion. As Professor Kapoor says, 'It was heartening to note that the awareness levels today are fairly high among the interested school students, particularly those with access to computers and the internet.'

The enclosure to house the 14-inch Meade Telescope on the terrace of the Main Laboratory Annexe is almost ready. It is hoped that regular viewing by the public of the night sky will be possible starting early next year.

An informal History of Astronomy in Kannada



A historical account of Astronomy and Astrophysics in Kannada, which had been serialized earlier by the daily Samyukta Karnataka, has been brought out recently as a book by Navakarnataka Publications of Bangalore. The book has been written by **Professor P. R. Vishwanth** and was released a few months ago in a book-release function in Mysore. The title of the book

is BHOOMIYINDA BAANINATTA, which may be loosely translated as SKYWARDS FROM EARTH. The premier Kannada daily PRAJAVANI introduces the book in the following words: "The book describes the growth of the field from timekeeping to pulsars and quasars… There are also accounts of lives of eminent scientists. The author describes them all with a simple style. The book deals with many important aspects of astronomy."

The book has 6 chapters :

(1) Solar system : Measurement of time, Models of the solar system from early Greek to Renaissance times with lives of Aristotle, Copernicus, Galileo, Kepler, Tycho Brahe, Isaac Newton and William Hershcel.

(2) Photon and particles : the many faces of photons, neutrinos with lives of Bohr, Pauli and others.

(3) Stars: technological progress, life and death of stars with lives of Eddington, Chandrasekhar and Oppenehimer.

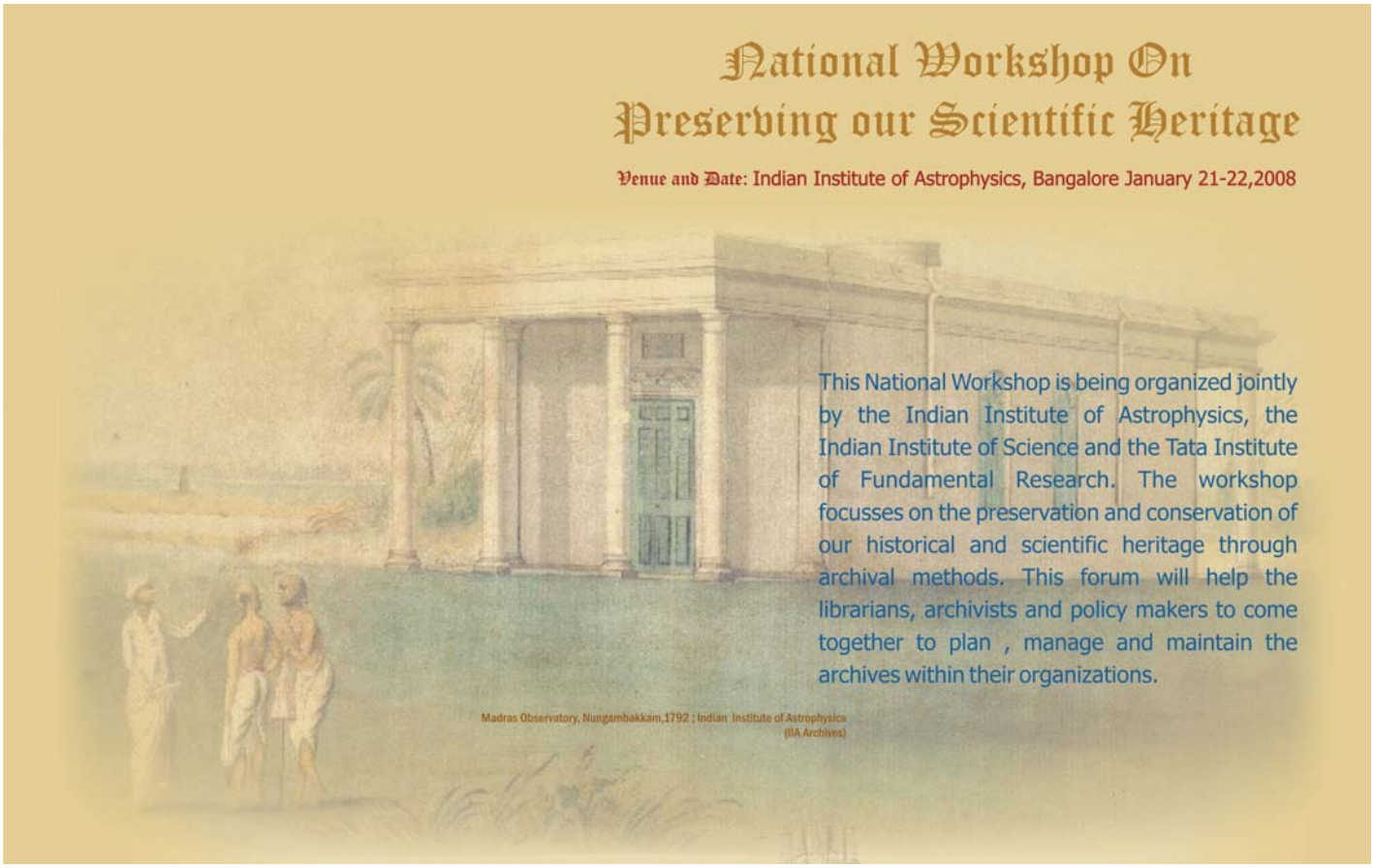
(4) Explosions : Supernovae, Crab Nebula, Pulsars, SN 1987A, Gamma ray bursts.

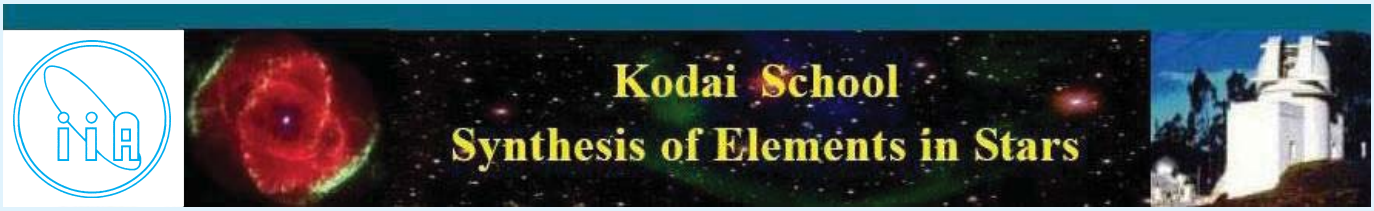
(5) New Astronomies : Galaxies, Quasars (Radio Astronomy), Black Holes(X-ray astronomy), Neutrino Astrophysics.

(6) Universe : Expansion, Creation, Age, Dark matter etc with lives of Hubble and Hoyle.

The appendix has three sections :

(1) Sociological Astronomy (Issues dear to the common man) : (a) asteroids, comets, extinction of dinosaurs, Tungaska (b) The possibility of other civilizations (c) Fundamental research in developing worlds. The book also gives a list of institutions in India which are involved in research and also of various kinds of telescopes. The book is about 180 pages long and contains many illustrations.





Venue & Date : Kodaikanal Observatory, Indian Institute of Astrophysics, April 29 - May 13, 2008

Background

The events in the journey of our universe from its beginning are coded in the form of chemical elements. Understanding the mechanisms of synthesis of these elements at various stages of stellar evolution is fundamental to our understanding of these events. The distribution of various nuclear species in the cosmos, is however, the result of many different processes in the past, and understanding these processes is vital to our understanding of stellar evolution, chemical evolution of the Galaxy and its formation.

The school is aimed at communicating the excitement of this subject to beginners and young researchers. It is intended to cover a wide range of topics from the essential basics of nucleosynthesis and stellar evolution centered around the main theme of the school. A multi-institutional faculty will cover different topics, including hands-on sessions.

Topics to be covered

1. Basic properties of nuclei
2. Thermonuclear reactions
3. Cosmological nucleosynthesis and abundances of light elements
4. Stellar structure and evolution
5. Synthesis of elements in low-mass, intermidiate-mass and massive-stars
6. Neutron-capture processes and synthesis of heavy elements
7. Cosmochronometry
8. Chemical compositions of stars: Observational methods and analysis techniques

The HRD Ministry has nominated Prof. S. S. Hasan as a 'Scientist Member' of the Governing Board of IUCAA for a period of three years with effect from Sept 26, 2007. Consequent to this, Prof. Hasan has become a Member of the Governing Council of IUCAA.

Prof.Hasan has been invited to the membership of the Academic Council of Poorna Prajna Institute of Scientific Research, Bangalore, for a period of three years with effect from October 1, 2007.

Editors: D. Banerjee, D.C.V. Mallik, B. A. Varghese

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