IIA Newsletter

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In this issue...

Founder's Day

The eightieth birthday of Dr M K Vainu Bappu was celebrated on August 10, 2007. A large gathering of the staff and students of the institute was present at the IIA auditorium where the bronze bust of Dr Bappu was garlanded by the Director, Professor Siraj Hasan and by the Chief Guest, Professor P Balaram, Director of the Indian Institute of Science, Bangalore.

In his opening remarks, Professor Hasan described how Dr Bappu's painstaking efforts led to the transformation of the Solar Physics Observatory in Kodaikanal of which Bappu was the director into this autonomous research institute devoted to the studies of astrophysical sciences.Recalling Dr Bappu's contributions, he said that Vainu Bappu inspired an entire generation of astrophysicists in the country and provided them with opportunities to pursue their career. Today the research activities of IIA have expanded to other regions of the electromagnetic spectrum — from gamma rays to the ultraviolet to low-frequency radio waves. Bappu had found the observational facilities in Kodaikanal lacking in night time astronomy and he initiated efforts towards establishing a modern optical observatory in peninsular India. The observatory in Kavalur and its large optical telescope bearing the name of Vainu Bappu are a testimony to Bappu's enduring vision. Vainu Bappu passed away in 1982 before seeing the completion of his dream project-installation of the indigenously built large optical telescope in Kavalur. Addressing the large gathering, Professor Hasan said, "We still miss him but his guiding spirit is always with us and on his birthday, which we celebrate as the Founder's Day, we make a fresh pledge to dedicate ourselves to carrying on with the tasks ahead."

Professor Hasan then introduced Professor Padmanabhan Balaram, the distinguished speaker of the Founder's Day lecture. Later Professor Balaram visited the IIA Archives and the Photonics Laboratory.

Measuring and Assessing Science

Scientometrics, the science of measuring and assessing the scientific output of individual scientists, and the performance of scientific journals and scientific institutions is a relatively new science. Its origins may be traced to Eugene Garfield and his seminal paper in *Science* in 1955 which led to the Science Citation Index (*SCI*) and is the forerunner of today's Web of Science. At the outset one should make a distinction between the academic science, the kind we practise, and applied science. While the former is of uncertain utility, the latter has very clear goals and targets. In the early 1970s, when I started my research career, the most eagerly awaited weekly arrival in a science library was the Current Contents. It had the largest readership. Its pages were zealously leafed through by all serious researchers and soon reprint requests were sent in the mail to all corners of the world. Today, one may sit in the comforts of one's office and find the same or even more comprehensive information on publications on the internet through the courtesy of various abstracting services which are available on-line.

Scientometrics is an impersonal quantitation of output and impact of the science produced and is a measure of scientific and technological progress.The practitioners of this science have evolved methods which are applied in measuring scientific productivity, impact of scientific work, evaluation of scientific journals and of institutions that pursue science.

Today Scientometrics is practised widely and the methods are constantly improving. Some startling conclusions have emerged through such analyses. For example, it has been found that a relatively small core of journals accounts for as much as 90% of the significant literature and that 20% authors contribute to over 80% of the literature. Of all the papers published between 1945 and 1988, less than 16.02% have received 10 citations and 82% zero citations. It is generally seen papers which lead to the development of quantitative laboratory procedures in various disciplines, e.g., methods of protein estimation, x-ray analysis of structures, NMR or mass spectrometry, receive many more citations than papers which bring in original ideas, which led the physicist Freeman Dyson to remark, 'Science is often driven by new technology rather than by new concepts'. Both Nobel Prizes and citation counts support the above view.

Is the Nobel Prize a good indicator of the scientific impact of the work of an individual or a group of individulas? The answer is yes and no. In this connection, one may mention the great Indian biochemist Yellapragada SubbaRow, who worked for the most part of his life in the United States and who transformed medical science and our lives by making a large number of major discoveries but was never awarded the Nobel Prize. His work with Fiske on the colorimetric determination of phosphorus and the discovery of phosphocreatine and ATP is ranked twenty third among the most cited papers of all time. Yet SubbaRow's name was hardly known outside a small circle of scientists. In another case I discovered, one of the recipients of the Nobel Prize had very little to do with the discovery itself except that the discovery was made in a laboratory of which he was the head! The practice of alphabetical listing of authorship of a paper often hides the actual worker/s of the piece of work that is published.

In the current era, biological and biomedical research have occupied the largest share of research in terms of papers produced, number of scientists involved, number of journals and number of citations. Based on quantitative figures, physical sciences are several places below the above fields. The impact factors of journals is much in the news these days. The journal impact factor, which is the ratio of a certain year's citations to articles published in the previous two years to the total number of articles published during those two years, is a double-edged sword. A journal with a high impact factor automatically draws a larger number of submissions to it. But the acceptance of manuscripts in such a journal is uncertain forcing the authors to hunt for other outlets to boost the 'average impact factor' of their publication lists. The greater visibility attached to high impact journals can also attract greater attention to flawed papers. Few authors believe that a good paper is independent of the journal in which it appears. Citations are often based on criteria unrelated to the real quality of a piece of work but on the visibility of a journal where the work is published. Not all cited authors are always read by the authors who cite them. The highest impact journal in physics is the *Physical Review Letters*, which is ranked seventh among all scientific journals and the highest ranked journal in A&A is *The Astrophysical Journal* ranked 22nd. The top positions are all occupied by journals in biochemistry, medicine and pharmaceutical sciences.

There are a variety of methods for deciding on the academic ranking of universities and research institutions based on the impact of work done in these places. Such methods are constantly evolving and perhaps getting better. In a study done in 2003, a method was developed based on twenty one subject categories and five parameters to quantify the performance of the universities all over the world. The five parameters were — number of Nobel Laureates, number of papers in *Nature* and *Science* between the years 2000 and 2002, number of highly cited researchers between 1981 and 1999, number of articles in *SCI* and *Social Science CI* and the academic performance per faculty. In this analysis, Harvard came on the top, followed by Stanford, Caltech, Berkeley, Cambridge, MIT and Princeton with Oxford and Columbia ranked 9th and 10th. The highest ranked Indian institution was the Indian Institute of Science with a rank between 251 and 300 and all the IITs were below 450. Similarly, in an evaluation of the scientific impact of nations, USA was ranked top with the largest number of citations of work in which its share of top 1% cited publications was 62.76, followed by UK which had 12.78 as its share of the top 1% cited publications. India was ranked 22 where its share of top 1% cited publications was only 0.54.

One must qualify such analyses with words of caution particularly when they are applied to the Third World countries like India. It is a fact that even reasonably good and useful pieces of work from the Third World are cited less than work of similar calibre appearing from the Western laboratories. While editors of major journals have always maintained that there is no bias against manuscripts from the Third World at the level of editorial review, there are no easy methods to assess whether there is a citation bias that tilts against authors from the developing world. Similarly, in evaluating the academic ranks of institutions, since the criteria are usually developed based on conditions in the Western society, certain sociological factors that come into play for countries like India are ignored and again the ranking is favourably skewed towards the Western universities. One such factor is the drop-out rates from the universities. Harvard has an extremely high drop-out rate and the quantitative criterion used gives it a high ranking. Social factors prevent a high drop-out rate in Indian universities and therefore, they stand to lose in such an analysis. Yet there is no denying the fact that universities in India have been totally neglected since independence and even some excellent ones of the previous era, like the Allahabad University or the Universities of Madras and Calcutta, have now fallen far behind due to the general indifference of the funding agencies including the governments that have been in power.

A comparison of the total number of *SCI* indexed papers which emanated from India over the period 1980 - 2000 with that from countries like South Korea, Brazil and Israel showed that India's publication output was held steady over the period while the scientific output from the other coutries showed an appreciable upward trend. This has caused a consternation in the academic and governmental circles. Correlating the uncorrelated one is tempted to believe in a remark I read in an Indian newspaper in the context of the above finding that said 'Decline of science in India correlates with improvement in technology'.

(Based on the Founder's Day lecture by Professor P. Balaram.)

Quasars in Canada-France Hawaii Telescope Legacy

Quasar absorption lines are efficient probes of the gas content of the Universe. The so called Ly-alpha forest in quasar spectra contains information on the intergalactic medium and tells us about the spatial distribution of neutral hydrogen in the Universe. Similarly, the properties of gas in and around galaxies can be known by studying the correlation between the metal systems observed in the spectra of background quasars and galaxies in the field of view. Such a study needs deep spectroscopy of quasars and deep images of galaxies in the same field. This can be easily done, if a grid of background quasars is selected in fields where deep imaging is already available.

The CFHTLS is an ambitious imaging programme currently under way at the Canada-France Hawaii Telescope using MEGACAM, a 36 CCD mosaic camera. CFHTLS consists of a deep survey of four fields (D1, D2, D3 and D4) each covering about an area of 1 deg by 1 deg and a shallower survey of four fields (W1, W2, W3 and W4) each covering an area of 7 deg by 7 deg reaching final limiting magnitudes towards the end of the survey in the deep fields of 28.3, 28.5, 28.3, 28.3 and 27.0 respectively in u,g,r,i,z filters. The main goal of our project on the CFHTLS is to build a large grid of background quasars, with limiting magnitudes significantly fainter than the existing surveys like the 2dF and SDSS. Our initial optical selection of quasar candidates in CFHTLS were done in the D1-W1 (as it has SWIRE and XMM coverage) and D4 fields (as it contains an already known central quasar) down to g < 22.5 mag (~3 magnitudes fainter than the SDSS quasar survey) using 2-D colour-colour criteria, coupled with the photometric redshift code *hyperz*. A successful spectroscopic observing run was carried out in September 2006 using AAOmega at the AAT achieving integration times of 15 and 10 hours on D1-W1 and D4 respectively. For the D1-W1 field, three pointings were used to cover about 5 square degrees (see Figure 1). Based on the optical, X-ray and mid-IR selection at g < 22 mag, a total of 2789 quasar candidates were found. Successful observation were possible on 1977 quasar candidates, of which 858 turned out to be new quasars. Similarly, for the D4 field, 754 quasar candidates were selected down to g < 22.5 mag. 749 of them were observed of which 274 were identified as quasars for the first time. Quasar candidates which were not observed during the 2006 AAT run, are planned to be observed during the allocated AAT time in mid-September 2007.The best groups of quasars discovered in our September, 2006 AAT run will be followed up at higher spectral resolution, using the VLT towards the end of this year, so that some of our basic science goals are addressed.

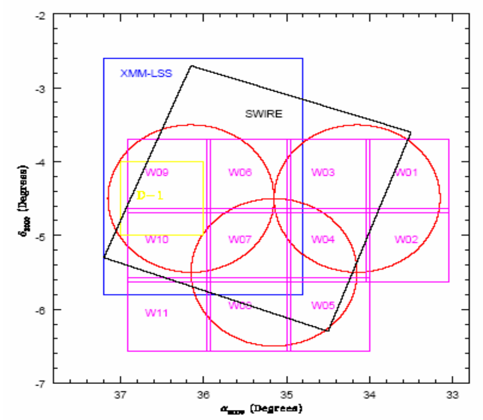


Figure 1: Coverage of different surveys around the D1-W1 field. The three AAT pointings are indicated by circles. XMM and SWIRE observations are the big rectangles and CFHTLS pointings are the small squares.

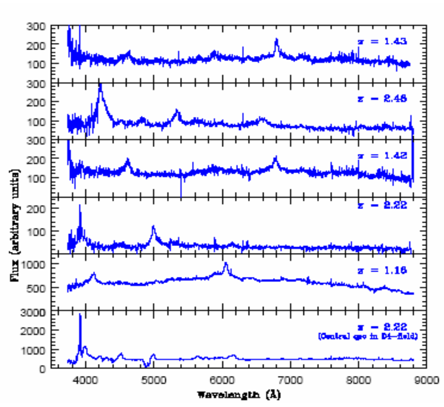


Figure 2: AAT-AAO spectra of z>1.0 quasars discovered in D4 within ~10 arcmin from the known central quasar LBQS~2217-17.

- C. S. Stalin

Parametrization of Stars using Medium Resolution Spectra

We have initiated a programme for automated stellar parametrization using medium resolution spectra (R ~1000) obtained with the OMR spectrograph at the 2.3-m Vainu Bappu Telescope at VBO, Kavalur. Our sample contains uniform distribution of stars in the temperature range 4500 to 8000K, log g range of 1.5 to 5.0 and [Fe/H] range of 0 to -3. We have explored the application of artificial neural network (ANN) for parametrization of these stars. Automated procedures such as ANN have the advantages of high speed, objectivity and providing homogeneous data set most suited for Galactic structure and evolutionary studies. ANN is a computational method which provides non-linear parametrized mapping between an input vector (a spectrum for example) and one or more outputs like SpT, LC or T_{eff}, log g and [M/H]. However, a network must be trained with the help of representative data patterns. These are stellar spectra for which classification or stellar parameters are well determined. The training proceeds by optimizing the network parameters (weights) to give minimum classification/parameter error. Once the network is trained, the weights are fixed and the network can be used to produce output SpT, LC or T_{eff}, log g and [M/H] for an unclassified spectrum. We have used a software developed by B.D. Ripley based on the back propagation technique. We have observed a set of 90 stars with well determined atmospheric parameters for training the networks for temperature, gravity and metallicity estimations. Figure 1 shows a few representative spectra. The preliminary results based on 680:11:3 architecture yielded an accuracy of 200K in temperature, 0.4 in log g and 0.3 dex in [Fe/H].

The figure has been chosen as the cover page of the Proceedings of JD 13 on "Exploiting Large Surveys for Galactic Astronomy" conducted by IAU Commission 45 during XXVI General Assembly of IAU in Prague.

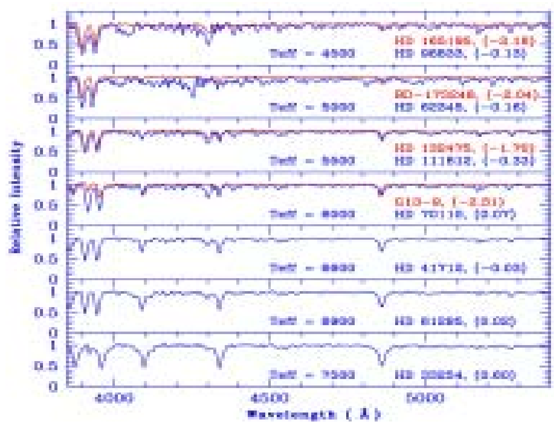


Figure 1: The metal-poor stars are plotted with red colour

- Sunetra Giridhar

Performance of the newly fabricated Zerodur Primary Mirror of 102-cm Telescope

The original primary mirror (Pyrex) of the 102-cm telescope in Kavalur had developed a series of patches on the surface which affected the reflectivity and hence the performance of the telescope. It was decided to replace the primary mirror with a new mirror made of Zerodur material. A Zerodur blank was procured and the mirror was fabricated at the Photonics Division with matching specifications as that of the old Pyrex mirror. An optical surface figure close to that of the old mirror was achieved for the new mirror. The side pocketing for retaining the support, the mirror under final evaluation and the corresponding typical interferogram are shown in Figures 1, 2 & 3. A matching figure better than $\lambda/20$ rms was achieved, in the fabrication shop.

Figure1:Side pocketing

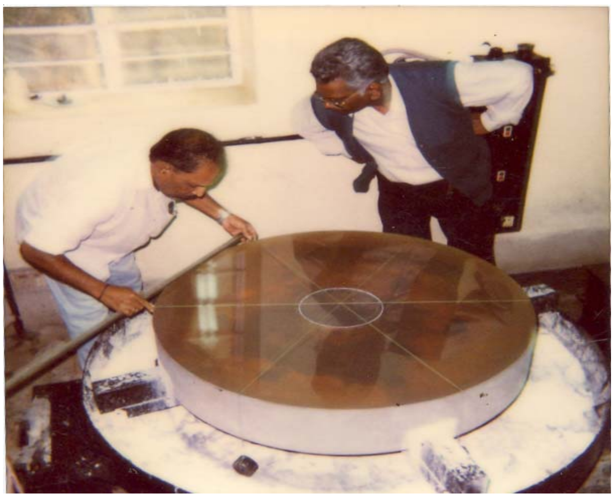


Figure 2: Mirror under evaluation

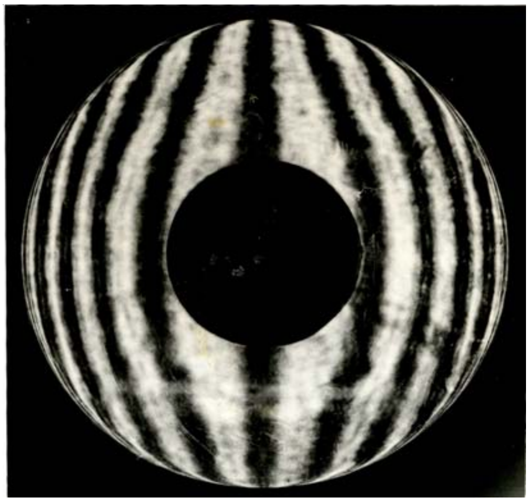


Figure 3:Final interferogram

Due to the higher density of the Zerodur material, the excess weight of the mirror had to be compensated by modifying the counter-weight and the support systems. With the support and encouragement provided by Prof. S.S.Hasan, the new mirror was reinstalled in the telescope and fine tuned. The telescope was ready for test and evaluation by May 2006.

Test observations were carried out on a couple of days during February 2007 to study the optical performance of the 102-cm telescope with the newly fabricated primary mirror. The mirror support system and the optics were further fine tuned. All the images taken for test observations were seeing averaged. The detector used was a 2K×2K Pixcellent CCD in 2×2 binning mode. This gave an image scale of 0.42″ per pixel. Figure 4 shows the radial distribution of intensities and intensity contours of a star field (δ= +02° 47′, h.a.= 22^h 56^m).

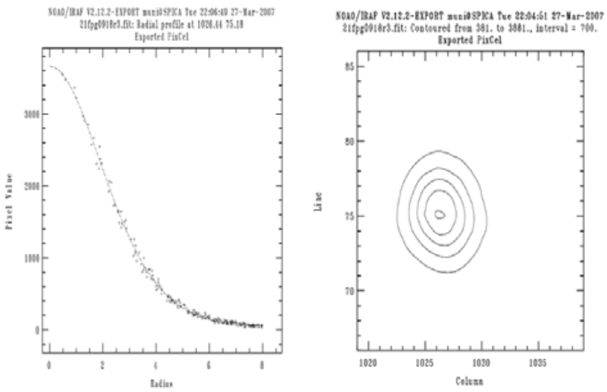


Figure 4: Radial distribution of intensities

We found that the radial profile of the image has very low scatter and the profiles of other stars across the CCD frame show a similar trend. The images are found to be circular with an FWHM of 1.9 arc sec.

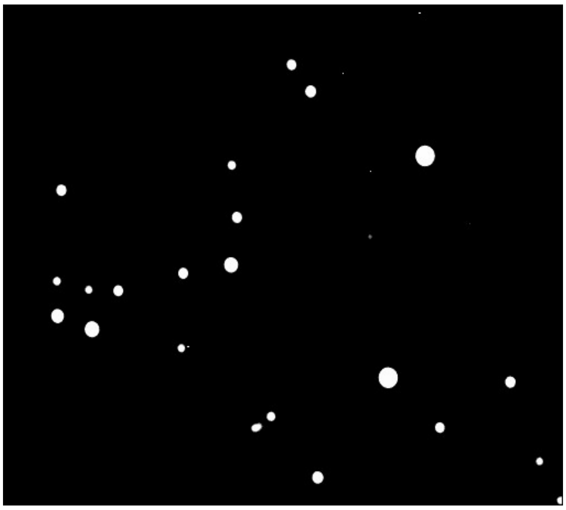


Figure 5 is an image of a star field, M 67 (δ=+11° 48′, h.a.= $01^h 43^m$) taken on the night of March 17, 2007 under poor seeing conditions. Here also the images are found to have circular symmetry but with large FWHM.

In order to have a comparative estimate on the performances of the old Carl Zeiss mirror and the new one, growth curves were plotted using the images taken with these two mirrors. Data taken on February 15, 2002 and February 21, 2007 respectively were used for the purpose. Encircled energies thus obtained in each case are plotted in Figure 6.

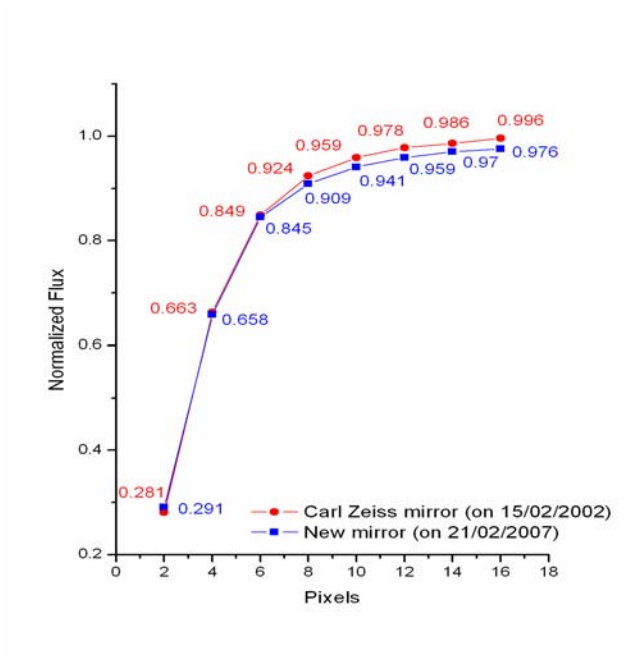


Figure 6: Encircled energies

We find that the curves follow a similar trend except a small difference of less than 2% at the wings. The reason for this small difference needs to be investigated. More photometric observations with the telescope during the coming season are being planned. It is also worth investigating if any degradation of ambient seeing inside the telescope dome had taken place over the past five years. The achieved performance is the result of painstaking efforts of members of Photonics team, Mechanical group and Electronics group. The consultations with Mr.S.C. Tapde and Mr.B. Mallikanadh are thankfully acknowledged. Involvement of Prof.A.K.Pati and Prof.Sunetra Giridhar during the modification and installation stages is greatly appreciated.

- A. K. Saxena, S. Muneer, F. Gabriel, and K. Kuppuswamy

Mini-Workshop on Hinode X-Ray Telescope (XRT) Data Analysis

Solar-B (Hinode - Sunrise in Japanese) satellite which is a successor to Solar-A (Yohkoh) was launched successfully on September 23, 2006 from Japan. Hinode was developed at ISAS and NAO, Japan, in cooperation with NASA, PPARC and ESA. It has three main instruments, namely, the Solar Optical Telescope (SOT), the soft X-Ray Telescope (XRT) and the EUV Imaging Spectrograph (EIS). Recently, the data from the satellite has been made public for the benefit of researchers working on the Sun.

A Mini-Workshop to deal with the data obtained from the Hinode X-Ray Telescope was organized at the Institute (IIA) on July 3 and 4, 2007. There were about 30 participants from IIA, IISc, ISAC/ISRO and CfA (Harvard-Smithsonian Center for Astrophysics, Cambridge, USA). Siraj S Hasan, the Director made the opening remarks followed by introduction of the speakers from CfA. The first talk was an overview of solar and stellar coronae by Vinay Kashyap and Loraine Lundquist (CfA). The next talk given jointly by Monica Bobra and Loraine Lundquist (CfA) was focused on the instruments on Hinode (XRT, EIS, SOT) and the first results obtained from the mission. The afternoon session on July 3 was on interactive data analysis which was conducted by Monica Bobra and Loraine Lundquist. They described the methodology of retrieving XRT data from the Virtual Solar Observatory and the XRT website at http://xrt.cfa.harvard.edu, its processing and analysis using the XRT software. They also briefly mentioned about acquiring SOT and EIS data.

On Wednesday, July 4, a few scientific talks were presented during the morning session. Vinay Kashyap (CfA) gave a one-hour talk on ‘Differential Emission Measure and its use in the Hinode Data’. A talk on ‘Predicting Solar Cycle Using a Dynamo Model’ was presented by Piyali chatterjee (IISc) followed by Jagdev Singh’s (IIA) talk on ‘Temperature structure of coronal loops and XRT’. Three more talks, ‘Multi wavelength study of coronal loop dynamics as seen from CDS and TRACE’ by Dipankar Banerjee (IIA), ‘Observations of the solar corona at low radio frequencies' by R. Ramesh (IIA) and 'Solar Physics Research at the ISRO Satellite Center, Bangalore' by P. Sreekumar (ISRO/ISAC) and his colleagues were presented, ending the scientific presentations of the meeting. The interactive data analysis session continued on July 4 afternoon. Finally, a Group Discussion for joint observing programmes/ science projects was organized and the participants took active part in it.

As a follow-up to the Hinode XRT Workshop at the Indian Institute of Astrophysics, Monica Bobra (CfA) has prepared a web-page containing many resources at http://xrt.cft.harvard.edu/resources/IHY. Interested persons are urged to look into the above website.

- A. Satya Narayanan

First IIA-PennState Astrostatistics school

The first IIA-PennState Astrostatistics School was held at the Vainu Bappu Observatory in Kavalur during July 2 - 7, 2007.

The school was modelled on the Astrostatistics Schools of the Center for Astrostatistics, Pennsylvania State University in USA.The intent of the school was to enable practitioners to meet the two-pronged challenge of modern empirical astrophysics, viz., (a) the compelling need for rigour in the application of state-of-the-art statistical methods, and (b) the recent paradigm shift that involves routine data mining of large multiwavelength data sets, thus necessitating complex automated analytical processes that invoke a very diverse set of statistical techniques.

The school was designed to provide a strong conceptual foundation in modern statistics as well as a repertoire of the state-of-the-art statistical tools applicable to astrophysical problems. The school was designed by Jogesh Babu and Eric Feigelson of Pennsylvania State University with inputs from the IIA co-ordinators. A heavy emphasis was placed on lab sessions that used the open-source, multi-platform R software environment, which is the current standard in research-level statistical computation. David Hunter, a statistician from PennState and an expert on the use of the R software, conducted these sessions. Two new tutorials were added in this school to the erstwhile list of tutorials of the PennState Schools. The school was distinctive in its involvement of the members of the Indian statistical community. In addition to the three faculty members from PennState, five statisticians from the Indian Statistical Institutes, Bangalore and Calcutta, Cranes Software, Bangalore, and the University of Hyderabad constituted the teaching faculty. Thirty seven computers were set up by the Computer Management Team of VBO in the VBT Computer Lab for the hands-on sessions. They installed the R software on all the machines which included MS-Windows, Linux and Mac OS platforms. The tranquil and isolated venue of the Vainu Bappu Observatory facilitated the intense engagement that was demanded of the school.

The school was open to astrophysics practitioners at all levels that were affiliates of Indian institutions. Since this was the first school of its kind, preference was given to participants from IIA and to the advanced graduate students. There were a total of 37 participants in the school, 11 from IIA, Bangalore, 5 from IIA, Kavalur, 8 from the university sector, and the rest from other astrophysics institutes in the country.

The lectures on Statistics were brought out in the form of Lecture Notes, hard copies of which were made available to the participants at the start of the school. The website of the school is being maintained, and all the lecture notes as well as the tutorials and data sets are available on the website (www.iiap.res.in/astrostat).

The school made for an enthralling experience, both pedagogically, and in terms of the coming together of astrophysicists and statisticians. The organisational success of the the school was due to the hard and diligent team work of the organising committee, that included Anbazhagan Poobalan, Margarita Safonova, S. Muneer, K. Kuppuswamy and Firoza Sutaria, in addition to Prajval Shastri (Chair) and Sabyasachi Chatterjee. Special mention must be made of the administrative support provided by S. B. Ramesh, K. Sankar, K. Lakshmaiah, A. Narasimha Raju, K. Mohan Kumar and the VBO team. Prajval Shastri and Sabyasachi Chatterjee from IIA and Jogesh Babu of PennState were the co-ordinators.

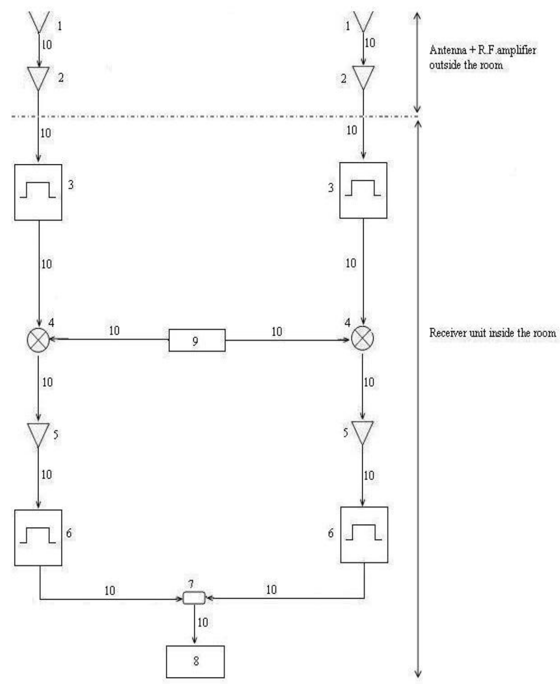
-- Prajval Shastri

A Two-element Radio interferometer for observations of Sun and other strong Cosmic Radio sources

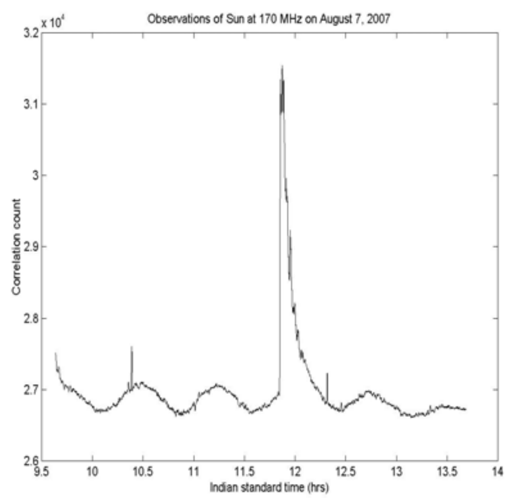
As a part of the International Heliophysical Year (IHY) and the institute's Public Outreach Programme (POP), it is proposed to provide hands-on astronomical observing experience to interested science and engineering graduate student community in the country by donating a radio antenna and receiver system to their institutions. The students will be trained to: (i) carry out observations of radio emission from the Sun and other strong cosmic radio sources with the above set-up, and (ii) develop software for deriving quantitative information from the data acquired.

A prototype system has been designed and is presently in operation at the Gauribidanur Radio Observatory. The radio frequency (R.F.) signal reception set-up is a simple interferometer. It consists of two half-wave dipole antennas (tuned to receive R.F signal at 170 MHz) separated by ~ 10 m. The R.F. signal incident on the antennas are amplified independently in a broad band amplifier (Gain, G ~ 28 dB) and then transmitted to the receiver room via coaxial cables of length about 50 m. The signal attenuation in the cable is about 10 dB at 170 MHz. In the receiver room, the signal from each antenna is first passed through a band pass filter of centre frequency (f_c) = 170 MHz and bandwidth (Delta f) = 6 MHz, to minimize the contribution from interfering signals at other frequencies. The insertion loss in the filter is about 3 dB at 170 MHz. The filtered signal is then mixed with a local oscillator (L.O.) signal of frequency 180.7 MHz for down converting the R.F. signal to an intermediate frequency (I.F.) of 10.7 MHz, which facilitates further processing. The output of the mixer is amplified by about 28 dB (to ensure the minimum peak-to-peak level of ~ 100 mV for the input signal to the correlator) and passed through a band pass filter with f_c = 10.7 MHz and Delta f = 1 MHz, again to minimize the contribution from spurious signals at other frequencies. The combined loss in the mixer and filter is about 8 dB. The output of the filter is finally fed to the correlator. The latter has also provision for integrating the correlated data before passing it on to the computer for storage.

The following figures show the block diagram of the antenna + receiver system and observations of the Sun with the prototype system on August 7, 2007. In addition to the regular interference fringes due to emission from the background 'undisturbed' solar corona, one can also notice intense radio burst emission (around 12 IST) associated with transient activity on the Sun.



1. Antenna (Half-wave dipole tuned to 170 MHz)
2. R.F. amplifier (Gain = 28 dB)
3. R.F. band pass filter (f_c = 170 MHz; Delta f = 6 MHz)
4. Mixer (for down converting the R.F. signal)
5. I.F. amplifier (Gain = 28 dB)
6. I.F. band pass filter (f_c = 10.7 MHz; Delta f = 1 MHz)
7. Digital correlator
8. Data acquisition system + computer
9. Local oscillator (180.7 MHz, Amplitude = 7 dBm)
10. R.F.coaxial cable



- Radio Astronomy Group

HAGAR attains Synchronized Operation of all 7 Telescopes

On September 5, 2007, an important milestone in the High-Altitude Gamma-ray Array project (HAGAR) has been attained. The synchronized operation of all the seven telescopes of HAGAR has been successfully carried out from the Central Control Computer. A servo pointing accuracy of +/-10 arcsec has been obtained. Modeling of the telescopes for pointing to celestial objects is in progress. With the progress made so far, it is anticipated that science observations could commence by December 2007.

As reported earlier (Newsletter, Volume 11, Page 7, November 2006) IIA together with TIFR embarked on setting up a high altitude gamma ray array at the Indian Astronomical Observatory, Hanle. This facility is designed to study gamma rays emitted by quasars, pulsars, supernova remnants, gamma ray burst sources etc using the Atmospheric Cerenkov Technique. The array itself consists of seven alt-az telescopes, with 6 of the telescopes located in a circle of 50 metres radius and the seventh telescope placed at the centre of the circle. The total collecting area of this array is about 30 square metres which enables the faint Cerenkov light caused by the gamma ray photons arriving from celestial sources to be captured efficiently. The threshold energy of capture of the gamma rays, to be attained with this facility at Hanle, is expected to be in the region of about 50 GeV. Lowering the threshold to 50 GeV opens up new vistas in Gamma Ray Astronomy.

HAGAR Team – IIA & TIFR

Open House (Bangalore Campus)

An Open House was organised on August 9 and 10, 2007 to which science students from a few schools and several colleges were invited. Close to a hundred people visited the institute on the two days and attended the programmes organised by the Public Outreach Committee.

An exhibition of posters on the Sun, Space Weather and Solar-terrestrial relationships was set up as a theme exhibition celebrating IHY 2007. A special attraction was the STEREO image of the Sun which could be viewed in 3D using special glasses which were made available to the viewers. Also on display were models of our major telescopes and posters and a model of the TAUVEX payload.

A two-element radio interferometer for observations of the Sun and other strong sidereal radio sources was also set up and proved to be a a major attraction, particulary to the science students from colleges. Two dipole antennas were placed in the volley-ball court outside and the electronics and the display system were set up in the Exhibition Hall. The radio astronomers of IIA described the instrument and showed the interference fringes formed by the Sun. The weather co-operated and at one stage even the Sun obliged — there was an intense radio emission which was easily caught on the instrument.

The simple box spectroscope rigged up earlier by the IHY Public Outreach group was made available to the visitors. The spectroscope can be used to view the spectrum of a terrestrial light source or of the Sun. The visitors to the exhibition had an opportunity to see the solar spectrum.

Out in the open, Navnirmiti of Mumbai set up their low-cost no-cost tools with simple demonstrations on how to measure the Universe with a string and a stone. Among the tools used were the Ball and Mirror Solar Projector, Pinhole Projector and the Sun Card, and the Very Long Focal Convex Lens Projector. The school students were enthralled by the simple experiments.

The film 'Hubble - 15 Years of Discovery', presented by Bob Fosbury, was shown in the auditorium. On August 9 Dr Vivek Monteiro (Navnirmiti, Mumbai) spoke on "Sunderstanding - the Sun as a learning resource for universalising science" and on August 10, Prof. Jayant Murthy gave a talk on "Science from Space: 50 years of Space Flight".

Sunderstanding the Sun as a Learning Resource for Universalizing Science

The Sun is an unparalleled resource for learning science, mathematics, and technology. It has been described as a wonderful laboratory in the sky which all the affluent nations in the world together could not afford to build. Yet it is available in the most remote village, anywhere in the world. Sunderstanding is a programme being developed by Navnirmiti for universalizing understanding of the Sun with low cost, no cost tools, and using the Sun as a universal tool for understanding Science, Mathematics and Technology (SMT). Study of the Sun can be made a part of every school curriculum from the primary level onwards, with wonderfully simple, and simply wonderful experiments for learning SMT at every level. We can use the study of the Sun to promote:

1) Scientific enquiry and secular culture
2) School geometry and trigonometry
3) Appreciation of the energy crisis and renewable energy
4) Biomass conversions, carbon calculations, the life sciences and agriculture
5) Understanding of energy and its transformations
6) Observing eclipses, sunspots, solar spectrum, introductory astrophysics.
7) Observing the transit of Venus as a first step to measure the universe
8) Discussing the history of science and mathematics
9) Dispelling superstitions and debunking astrology

The measurement of the Sun's distance is a non trivial problem.Even Galileo and Newton did not know this number. Horrocks attempted to measure this during the 1639 Transit of Venus. He made a wrong assumption, else he would surely have gone down in history as the first person to measure the Astronomical Unit. With a simpler assumption every child can measure the distance of the Sun correct to about 10%. This can be easily done from the photographs taken from the 2004 Transit of Venus. This will be possible again during the next Transit of Venus which will occur in 2012, five years from now. This is sufficient time for building an international education campaign which will reach every school in every country around this event. A dress rehearsal of such a campaign took place in India through the All India Peoples' Science Network in 2004 in which thousands of students from urban, rural and tribal schools successfully participated. Every school can build a terrasunlab on open ground or its terrace, with low-cost and no cost tools made by the students themselves and perform powerful experiments.

- Vivek Monteiro

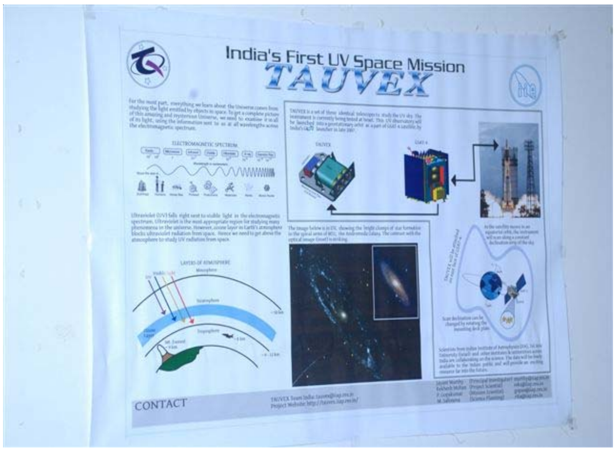
Science from Space

The year 2007 marks the golden jubilee of Space Exploration, as on October 4, 1957, the Soviet Union launched into space Sputnik I marking the beginning of a new era in scientific exploration and in the cultural history of mankind. The generation in infancy then has grown to today's leaders in science and technology and the succeeding generations have all been deeply influenced by the events related to space exploration and space flights. In July 1969, two astronauts on board the Apollo 11 landed on the Moon and Neil Armstrong's words, as he stepped out, 'That's one small step for a man, one giant leap for mankind' resonated through the communication channel to the Earth changing the common man's perceptions of the world forever.

In his beautifully illustrated talk, titled 'Science from space: 50 years of space flight', Professor Jayant Murthy started with the picture of earthrise on the Moon. He severely criticised those who created an uproar calling the landing on Moon a hoax and he gave substantial evidence of their misrepresentations and alerted his young audience not to lend ears to such false campaigns. He went on to describe the benefits we have derived from space over the last several decades, how it has revolutionised global telecommunications, weather forecasting, remote sensing and has brought in wonderful devices like the GPS, which have hugely changed our day-to-day life and living style.

Professor Murthy said launching satellites to explore the Universe from space has changed the science of astronomy completely, since it has made possible for astronomers to look at parts of the electromagnetic spectrum which were beyond their grasp from the ground as the Earth's atmosphere blocks radiation from almost all regions of the spectrum except in the narrow gap we call the visible radiation and the long wavelength radio waves which have been tradionally used for broadcast.The atmosphere of the Earth also distorts images of the celestial objects and by going into space astronomers have been able to see much deeper and clearer. He mentioned the pioneers of rocket science who laid the foundation, people like Wernher von Braun, Konstantin Tsiolkovsky and Robert Goddard. In the latter part of the talk, Professor Murthy gave brief descriptions of several astronomical space missions and how they have enriched our knowledge of the Universe. He showed pictures taken with the Hubble Space Telescope and the nearly perfect blackbody spectrum of the cosmic microwave background obtained by the COBE satellite which brought the leaders of the mission the Nobel Prize in physics last year.

IIA is involved with the upcoming TAUVEX mission of which Professor Murthy is the Principal Investigator. He also mentioned other missions like COROT and LISA. In closing, he said, with space having become accessible and mind boggling amounts of data being collected, there has been a paradigm shift in the practice of astronomy. Astronomy research can now be done sitting at home with proper internet access, since data collected from these very expensive missions are now treated as public property and they no longer belong to a group of individuals beyond a stipulated short period. Computer revolution has brought power to people and has made scientific results publicly accessible. The talk was much appreciated by the audience which had a large number of college students from Bangalore attending it.



From the Archives

Preserving the Colonial Science

We are happy to announce the setting up of the IIA archives consisting of a part of the special collections of IIA. The collections are aesthetically displayed in a separate room adjacent to the library on IIA campus in Bangalore.

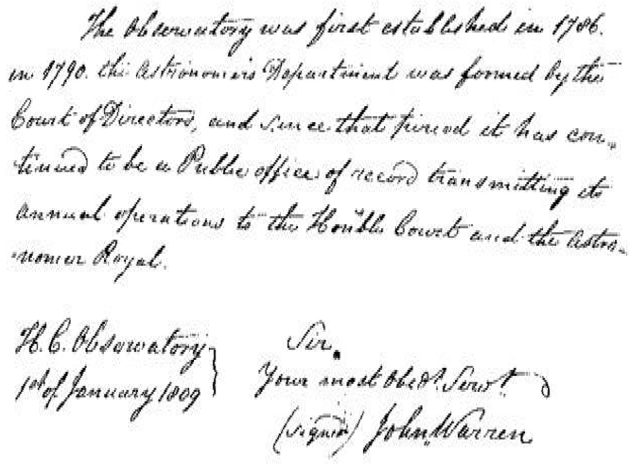
The process of setting up the archives involved various steps starting from drafting the collection policy to addressing the different preservation issues. As the institute has naturally inherited the library and records of the Madras and Kodaikanal Observatories going back to c.1786, the collection too has parallely grown to include more than 5000 items in various formats such as manuscripts, photographs, maps, films, awards, framed materials, hand-drawn sketches, pictures, and instruments. Most of these items are of historical importance and environmentally sensitive.

The various archival items and contents illustrate essentially the role played by the individual astronomers and the directors of our parent observatories and the institute and the description of the science done at different times. Hence we have chosen to classify and organize these items according to the directors chronologically.

IIA Library has taken the responsibility of arranging these items systematically contents wise, taking appropriate care to meet the storage specifications. The preservation process involves cleaning, fumigation, repair and rebinding. Some of the old hand-written manuscripts and scientific data sheets required photolaming and an encapsulation process to retain the originality and at the same time to give reinforcement, thus adopting the principle of reversible process. For a few rare documents, Indian National Trust for Art and Cultural Heritage (INTACH) is helping us to restore the manuscripts. The library staff have made efforts to index all these items, and soon the finding tool will be available for the users of the archives.

A reference library of the archival material has been created in digital form, accessible from the IIA Open Access Repository (http://prints.iiap.res.in). For those contents for which the full text is not available they can be consulted physically in the archives with permission.

Two interesting items from the old manuscripts are presented here. The first is a reproduction from an early manuscript which confirmed that the Madras Observatory, forerunner of the Indian Institute of Astrophysics, was established in 1786.


The Observatory was first established in 1786. in 1790. the Astronomer's Department was formed by the Court of Directors, and since that period it has continued to be a Public office of record transmitting its annual operations to the Hon'ble Court and the Astronomer Royal.

H.C. Observatory
1st of January 1809

Sir,
Your most obed.t Serv.t
(signed) John Warren

The above is a beautiful hand-drawn image of the Madras Observatory in Egmore taken from the manuscript "Astronomical Observations Madras 1792".

- Chritina Birdie and A. Vagiswari

J Hanumath Sastri, Senior Professor, retired from service on August 31, 2007 at the age of sixty two after a two-year extension. Professor Sastri continues as a Senior Visiting Professor.

P M S Namboodiri, Associate Professor, retired from service on July 31, 2007 on attaining the age of superannuation. Professor Namboodiri is continuing as a Visiting Associate Professor.

Shri S Muthukrishnan, Technical Officer, retired from service on August 31, 2007 on attaining the age of superannuation.

Snapshots of Vainu Bappu at work

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