आईआईए न्यूज़लेटर

IIA Newsletter

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In this issue...

अंतर्राष्ट्रीय खगोल वर्ष के समापन समारोह के समय विज्ञान रंगमंच के विषय में बेंगलूर लिटिल थिएटर के विजय पदाकी के साथ विचार विमर्श करते मैसाचूसेट्स इंस्टिट्यूट ऑफ़ टैक्नॉलाजी में रंग मंच एवं कला प्रोफेसर एलन ब्रॉडी (दाएं)

Alan Brody (right), professor of theatre arts at the Massachusetts Institute of Technology, seen with Vijay Padaki of Bangalore Little Theatre, during the discussion about science theatre at the closing event of the International Year of Astronomy at IIA.

IIA brought its International Year of Astronomy celebrations to a close on the 6th January, 2010, with a closing ceremony whose highlight was a thought-provoking public lecture by Alan Brody, Professor of theatre arts at the Massachusetts Institute of Technology, USA.

IIA used the occasion of the declaration of the year 2009 as the International Year of Astronomy, to give a major boost to its outreach activities, which had already taken off during the International Heliophysical Year of 2007. Sabyasachi Chatterjee summarised these activities at the closing ceremony. With preparatory efforts that began in 2008 itself, IIA was well-poised to undertake a variety of activities that emphasised increasing their effectiveness and reach very significantly among the public at all levels. One of the first activities initiated was an extension programme with the Government High School, Madivaala in IIA's neighbourhood. IIA designed and executed an astronomy tableau for India's Republic Day parade at New Delhi. A large number of public sun- and night sky-watching programmes

both at IIA and in public spaces such as the Lalbagh Gardens were held in collaboration with the amateur astronomy group, Bangalore Astronomical Society and the science popularisation group Bharatiya Gyan Vigyan Samiti. They took place on a variety of occasions including National Science Day, the 2009 Solar eclipse, IYA09's *100-hours of Astronomy* and *Galilean Nights*, which resulted in the participation of several hundreds of people, especially in the public spaces. The commissioning of a play *Starry Messenger* on Galileo Galilei by Bangalore Little theatre, a cross-continental internet-streamed dance duet *Dance of Stars*, a series of public lectures on *Landmarks in Astronomy*, discussion meetings on gender equity in the sciences and showcasing of outstanding astrophotography by amateur astronomers were other activities of the year-long celebration. A major effort was the *100 Lecture Series* of country-wide public lectures on astronomy by IIA staff and students at a variety of fora such as schools, colleges, amateur astronomer clubs and public gatherings, which eventually totalled over 115. Another major effort was the distribution of educational kits designed by IIA, which included the hand-held Box Spectrograph, Solar Radio Interferometer and the Galileoscope. The low-cost Galileoscope (see IIA Newsletter, December, 2009), which was commissioned during IYA09, has been distributed to over 400 recipients all across the country.

Alan Brody enthralled the audience with his insights on the interplay between the practice of science and the perspective from theatre. He lectured on the topic *Enriching Science Education: The Role of Science Theatre*. As a professor at MIT, he is part of MIT's efforts towards incorporating a strong multi-disciplinary approach to learning. He is a well-known playwright and novelist, and penned the play *Small Infinities,* which explores the life and paradox of Isaac Newton, the scientific genius and father of modern science. Alan Brody was visiting Bangalore on the occasion of the performances of *Small Infinities.* The play was produced by Bangalore Little Theatre as part of its *History of Ideas project,* in which IIA is also a partner. Alan Brody's lecture was followed by a lively discussion moderated by Vijay Padaki, behavioural scientist, theatre educator and life member of Bangalore Little Theatre.

Sabyasachi Chatterjee concluded the proceedings by announcing that the International Year of Astronomy was mainly an occasion to make a strong beginning towards "universalising the universe".

Under K. M. Hiremath's guidance, **M. R. Lovely,** submitted her Ph.D thesis entitled "***Study of Dynamics and Magnetic Field Structure of the Solar Convective Envelope using Sunspot Activity"*** to the University of Calicut on December 20, 2009.

A major outreach activity initiated by IIA in IYA09 was the '100 lectures' series, a set of 100 public lectures to be given by IIA scientists to student and public audiences.Over a 115 lectures were given during the International year.

*Prajval Shastri : *Black Holes and Galaxies* (in Kannada), KRVP School Students' Programme, Kolar District, Karnataka (8 Dec)
*Ravinder K. Banyal: *Light: A Cosmic Messenger*, Parikrama Foundation, Koramangala, Bangalore (17 Dec)
* K. B. Ramesh: *Living with our active star - the Sun* (in Kannada), KRVP School Students' Programme, Yadgiri, Karnataka (18 Dec)
*Prajval Shastri: *Munching Black Holes and Growing Galaxies,* Bharatiya Vidya Bhavan, Bangalore (18 Dec)
*C. Muthumariappan: *Observing Facilities and Research Activities at IIA,* Educational tour for Christ college students, Kavalur (19 Dec)

Circular Polarization in Radio Pulsars

Pulsars are highly magnetised stars that produce beams of radiation which sweep across our line of sight. The rotating magnetic field of the star produces a strong induced electric field that accelerates charged particles off the surface of the star into a magnetosphere consisting of a predominantly dipolar magnetic field and corotating relativistic pair plasma. One of the explanations for the radiation from pulsars is spatially coherent curvature radiation emitted by charge bunches constrained to follow the field lines. The beamed radio emission from relativistic plasma, when constrained to move along the curved trajectories, occurs in the direction of velocity (see Fig.1).The resulting radiation will be polarised. We have developed a three-dimensional model for curvature radiation by relativistic sources accelerated along the dipolar magnetic field lines in pulsars (Gangadhara 2004, 2005). The polarisation state of the radiation in terms of the Stokes parameters was derived by taking into account the detailed geometry of the emission region in the pulsar magnetosphere, and both the uniform and modulated emission. An example of the pulse profiles that were simulated is shown in Fig.2.

Using these simulations, we confirm earlier results that the coherent curvature radiation from pulsars has basically antisymmetric type of circular polarisation, i.e., the circular polarisation changes sense in the central portion of the pulse. The antisymmetric type of circular polarisation survives only when there is modulation or discrete distribution in the emitting sources. We speculate that the propagation origin of antisymmetric circular polarisation is very unlikely. Though the emission from a single bunch is highly polarised, the net emission from many bunches within the beaming region is less polarised due to the incoherent superposition of the radiation fields. We find that the antisymmetric type of circular polarisation is correlated with the polarisation angle swing, consistent with earlier observational results (e.g., Radhakrishnan & Rankin 1990).This correlation is invariant with respect to the stellar spin direction.The observations of extremely high linear polarisation in strong single pulses from several pulsars (Mitra, Gil &

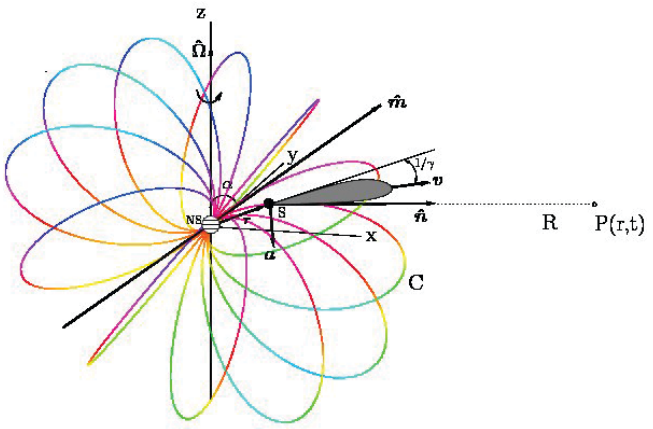

*Fig. 1. Geometry for the calculation of radiation field at P, which is at a distance R from the source S. The magnetic axis $\hat{m}$ is inclined with respect to rotation axis $\hat{\Omega}$ by α. The sight line $\hat{n}$ impact angle with respect to $\hat{m}$ is σ. The coloured curves represent the dipolar magnetic field lines. The source position vector is **r**, velocity is **v** and acceleration is **α**. NS is the neutron star and C is an arbitrary field line.*

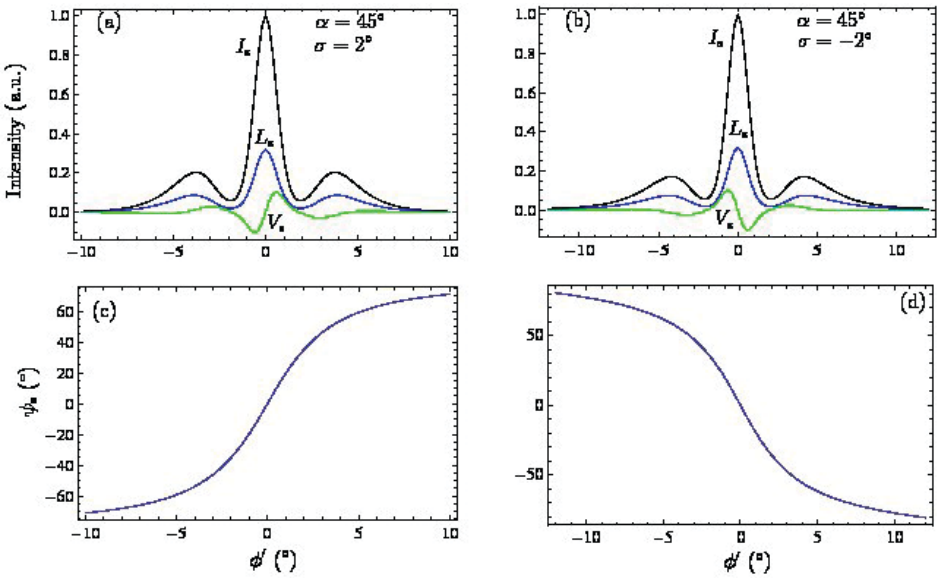

Fig. 2. Simulated pulse profiles are panels (a) and (b). The black curve is for intensity, blue for linear polarization and green for circular polarization. Polarization angle ψ_s is plotted in panels (c) and (d). In the case of positive sight line impact angle (σ=2°), the polarization angle χ_s swing is counter-clockwise with respect to rotation phase ϕ', while in the case of negative σ (–2°) the χ_s swing is clockwise and the sign change of V_s is from left to right.

Melikidze, 2009) which favour coherent curvature radiation over the maser mechanism as the observed emission, are very relevant for our model. The addition of circular polarisation with different signs and magnitudes at any given phase could be responsible for the wide diversity in circular polarisation across the pulse. *These results are published in the Astrophysical Journal, 2010, Vol. 710, page 29--44.*

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Gangadhara, R. T. 2004, ApJ, 609, 335
Gangadhara, R. T. 2005, ApJ, 628, 923
Mitra, D., Gil., J. A., & Melikidze, G. I., 2009, ApJ, 696, L141
Radhakrishna, V., & Rankin, J. M., 2009, ApJ, 352, 258

- R. T. Gangadhara

Aerosol Optical Properties at Hanle

As a part of the site characterization programme for the proposed National Large Solar Telescope (NLST), a Sky radiometer was installed at Hanle in Ladakh, in October 2007 to monitor and study the aerosol content and their properties at the site.

Aerosols, the micron sized suspended particles in the terrestrial atmosphere, modulate the solar radiation and hence limit the performance of ground based solar telescopes. Therefore, analysis of the aerosol content is an important input for the selection of a good astronomical site. Aerosol optical properties such as aerosol optical depth (AOD), single scattering albedo (SSA), volume size distribution, and refractive indices were retrieved using measurements of direct and diffuse solar irradiation through inversion computations.

The sky radiometer at Hanle (PM01L, of M/s Prede) consists of an automatic suntracking system, a spectral scanning radiometer, rain detector and a sun sensor with an in-built calibration capability, an automatic disk

scanner for calibration of solid view angle, and a single detector design. It has 7 filters with central wavelength at 315, 400, 500, 675, 870,940 and 1020 nm with bandwidths ranging from 2 to 10nm. The aerosol optical properties are derived from the measured sun/sky irradiance data at five wavelengths using the radiative transfer model of Nakajima et al. 1996 (Skyrad.Pack). The large quantity of data obtained at Hanle for over two years constitute a unique set at such high altitudes, especially in the mountain desert conditions of Ladakh in the Western Himalayas. The daily AOD values at Hanle (Fig. 1) are below the general background level observed at lower altitudes.

The inferred average values of SSA during winter and summer seasons are 0.96 ± 0.002 and 0.97± 0.002 at 500 nm, respectively . The higher values of SSA indicate strong absence of absorbing aerosols such as those of anthropogenic origin. The volume size distribution generally shows two peaks, and occasionally three peaks, usually in the summer months (Fig. 2), which may occur due to the inflow of desert dust at the site.The reported annual mean AOD at the high altitude sites in the central Tibetan Plateau (Nam Co 4720 m amsl) is ~0.05 at 500 nm (Cong et al. 2009). A very low value of 0.02 is reported at 400 nm for Dome C in Antarctica (Six et al. 2005). Hanle is a pristine site away from anthropogenic activities and the obtained aerosol optical properties are below background level comparable to regions like the central Tibetan Plateau and Antarctica. *These results have appeared in the Journal of Atmospheric and Solar Terrestrial Physics (Verma et al. 2010).*

References:

Cong, Z., et al., 2009, Atmos. Res., 92, 42
Nakajima, T., et al.1996, Appl. Opt. 35, 2672
Six, D., et al., 2005, Atmos. Environ., 39, 5041
Verma, N., et al., 2010, JASTP, 72, 115

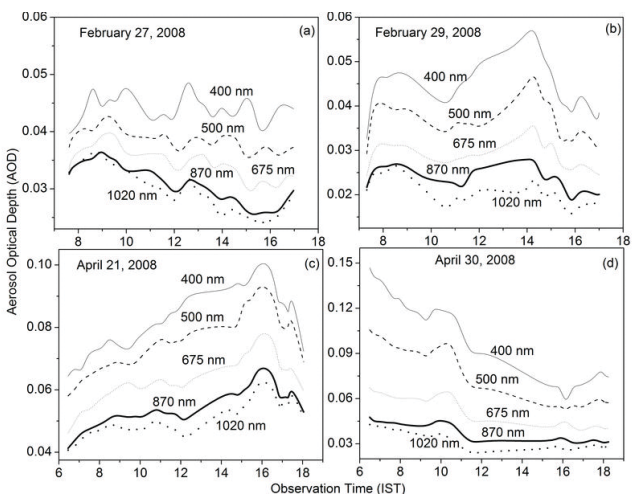


Fig. 1. Diurnal variation of AOD on two typical winter (a, b) and summer (c, d) days at Hanle.

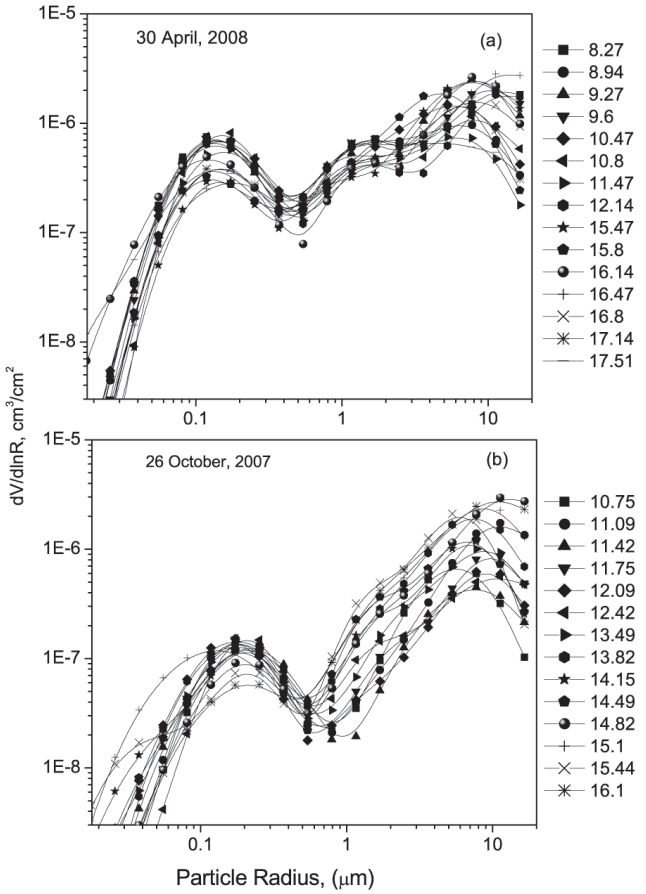
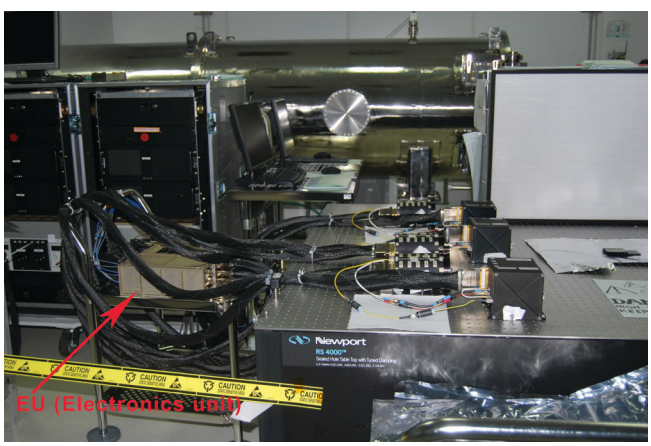


Fig. 2. Aerosol volume size distribution obtained on two typical days at Hanle during summer (a) and winter (b) periods of observation.

- Neeharika Sinha, Shantikumar Singh Ningombam, Rajendra Bahadur Singh, S. P. Bagare

UVIT on ASTROSAT

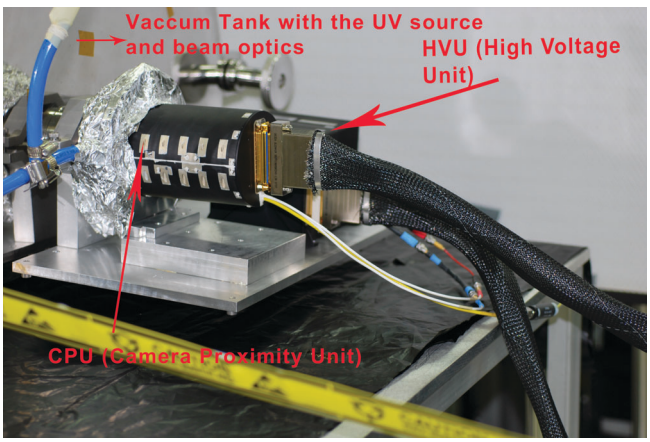
The "Flight Model" detector system of IIA's Ultraviolet Imaging Telescope that will fly on the dedicated Indian astronomy mission ASTROSAT, arrived at IIA in the last week of February from the Canadian Space Agency.



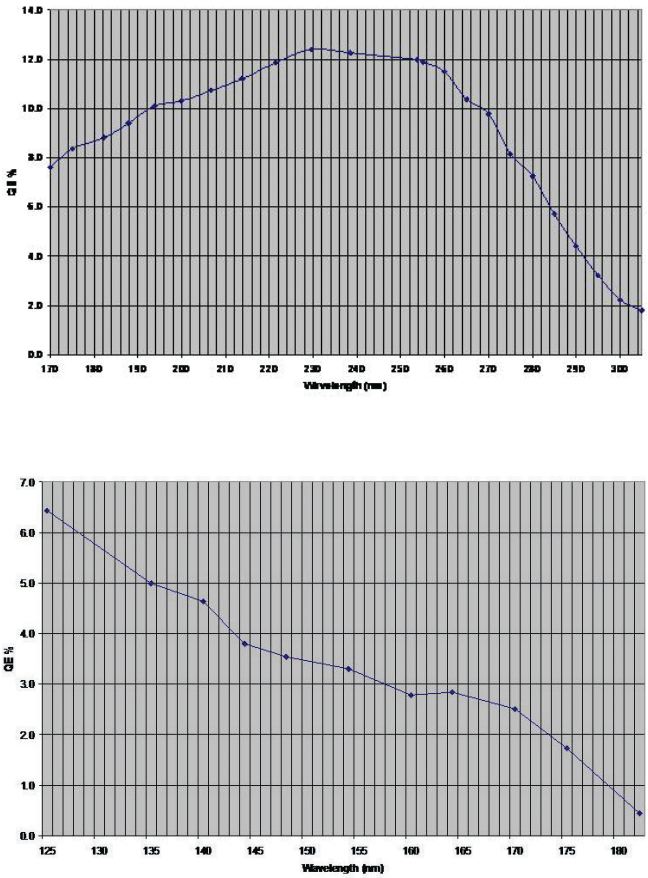
The far-and near-ultraviolet and visible detectors in Class 10,000 lab at CREST, for testing.

The Engineering model of the UVIT detector System underwent the EMI/EMC test at ISRO Satellite Centre (ISAC) in the first week of February 2010. The EM detector system has already qualified the EMI/EMC test at the **C**anadian **S**pace **A**gency (CSA), Canada. At ISAC, ISRO this test had to be repeated while simulating a more true to ASTROSAT grounding scheme. Results of EMI-EMC test appear satisfactory, but a full analysis of the test results is yet to be completed.

The Flight Model detectors were subject to laboratory tests in the first two weeks of March. Electrical and other performance tests have been successfully completed in the visible, near-ultraviolet and far-ultraviolet wavelength regimes. The results of the quantum efficiency tests are shown in the plots.



The setup for quantum efficiency tests of the detectors. A Class 100 air-blower is used to minimise contamination.



The quantum efficiencies of the flight-model detectors of the Ultraviolet Imaging Telescope in the Near-ultraviolet (top) and Far-ultraviolet (bottom) channels as measured during the test runs.

- UVIT Team

Kodai Winter School on High Energy Astrophysics

Participants at the Winter School on High Energy Astrophysics

A winter school on High Energy Astrophysics was held in Kodaikanal between 1st and 11th December, 2009. The school was organized jointly by the The Institute of Mathematical Sciences (IMSC), Chennai and the Indian institute of Astrophysics (IIA), Bangalore. The coordination was done by D. Indumathi and P. R. Vishwanath with excellent help from K. Sundararaman and staff of the Kodaikanal observatory. The emphasis was on neutrino astrophysics in the first week and gamma ray astronomy in the second week. While 33 students from all over the country attended the meeting, about half of them were Ph.D students and the rest from Master's programmes. After the inauguration by Prof. S. S. Hasan, Prof. G. Rajasekaran started the academic programme with a series of interesting lectures on the fundamentals of particle physics with a detailed exposition of the Standard Model. F. Sutaria, G. C. Anupama and S. Gopalakrishna introduced the students to topics in Stellar Evolution, Supernovae and Dark Matter respectively. M. V. N. Murthy, Kamalesh Kar, D. Indumathi, and Pijush Bhattacharjee lectured the students on different aspects of neutrino astrophysics like Atmospheric Neutrinos, Supernovae Neutrinos, Solar Neutrinos and Ultra High Energy Neutrinos respectively. There were talks on Cosmic Rays by Kalyanee Boruaha and general electronics by S. Upadhya. Talks on Low Energy Gamma Ray Astronomy, Gamma Ray production & Gamma Ray

processes were given by P. R. Vishwanath, R. C. Rannot and A. K.Tickoo respectively. Razmik Mirzoyan gave a series of talks on Gamma Ray Astronomy by Atmospheric Cerenkov Technique with emphasis on the MAGIC telescope. The students were given an in-depth look into the instrumentation and physics of new Indian initiatives in Gamma Ray Astronomy like HAGAR (Varsha Chitnis), MACE (Rannot and Tickoo) and in neutrino astrophysics like the INO (B. Satyanarayana). Evening lectures on LHC, X-Ray Astronomy and Indian Cosmic Ray Research were given by Rahul Basu, Biswajit Paul and B. S. Acharya. The feedback from the students showed that the pedagogical lectures and the interaction sessions were appreciated very much.

- P. R. Vishwanath

Astrostatistics session at Statistics Conference

The C.R. Rao Institute of Mathematics, Statistics and Computer Science, University of Hyderabad, organised an International Conference during 30 Dec 2009 - 2 Jan 2010 on the *Frontiers of Interface between Statistics and Sciences,* in honour of Professor C.R.Rao, the eminent statistician, who attained the age of 90 this year. At this conference, Priya Hasan, astrophysicist from Osmania University, organised a session on *Astrostatistics,* i.e., on fundamental statistical inference as applicable to astrophysical problems. The session was chaired by Siraj Hasan (IIA), and had talks by Prajval Shastri *(Challenges of Modern Empirical Astrophysics & Astrostatistcs)*, Najam Hasan of Osmania University (*Statistical Tools for Astrophysics*), and Priya Hasan *(A Statistical Study of Open Star Clusters*).

- Prajval Shastri

Indo-EU Workshop: Research Infrastructure

A two-day workshop was organized on 11-12 January 2010 at Indian National Science Academy, New Delhi, by the Departments of Science & Technology (DST) and Atomic Energy (DAE), Government of India, Indian National Science Academy, and the European Strategy Forum on Research Infrastructures (ESFRI). T.P. Prabhu attended the first day and made a presentation on the Himalayan Chandra Telescope, Hanle.

The ESFRI delegation was led by Carlo Rizzuto, Chair, and included Herve Pero, Executive Secretary, Elena Righi-Steele, member, Executive Secretariat, as also R. Schilizzi, Director, International Square Kilometre Array (SKA) Project.

R. Chidambaram, Principal Scientific Advisor to Government of India, T. Ramasami, Secretary, DST, and Herve Pero spoke in the inaugural session. Ramasami remarked that scientific research should aim at high discovery as also high social relevance. Pero drew a parallel between the linguistic diversity of the European Union and the Indian Union, and also emphasised the importance of human resources or"personware" for research. He described the ESFRI Roadmap 2008 which aims to integrate the research facilities of European countries and develop them for high scientific quality research infrastructure. Several sessions covered the research infrastructure and development plans in the EU and India in the areas of Biodiversity, Biomedical

Sciences, Arctic Research, Physical Sciences with emphasis on astronomy, nuclear and particle physics, and also e-infrastructure, including data archives, networks and grids, and supercomputing.

The session on astronomy had presentations by R. Schilizzi on the Square Kilometre Array (SKA),Yaswant Gupta on the Giant Metre-wave Radio Telescope and India's contribution to SKA, and Elena Righi-Steele on other projects such as the European Extremely Large Telescope, Cerenkov Telescope Array (CTA), and Cubic Kilometre Neutrino Telescope. She noted that astronomy is driven by technology and forms a major component of research in the Physical Sciences and Engineering in the EU. Tushar Prabhu discussed the research infrastructure at the Indian Astronomical Observatory, Hanle, the Himalayan Chandra Telescope, the site at Hanle and the scientific potential of Changthang Ladakh, and the support provided by the infrastructure to other projects such as the Indo-French collaboration on global climate studies. Ramesh Koul spoke on the Himalayan Gamma Ray Observatory which includes the recently commissioned Himalayan Gamma Ray experiment and the Major Atmospheric Cerenkov Experiment under development. He opined that Ladakh can be seriously considered as the northern site for CTA.

- T. P. Prabhu

Conference: Cosmological Reionization

Sivarani participated in an international conference on cosmic reionization which was held at theHarish Chandra Research Institute, Allahabad, during 16-20 February 2010. Reionization of cosmic hydrogen is an important milestone in the formation of structures in the Universe as it connects the small inhomogeneities observed in the Cosmic Microwave Background Radiation to the highly non-linear structures (i.e., galaxies and clusters) seen today. At the conference, about 55 participants deliberated and gave talks on the measurements of the temperature and polarisation anisotropies of the Cosmic Microwave Background, observations of distant star-forming galaxies, probes of reionisation, gamma-ray bursts and Ly-alpha emitters, and also detailed modelling and simulation of these high-redshift observables. Sivarani Thirupathi discussed her work on probing the cosmic reionization with Galactic archaeology. She discussed clues for reionizing sources in our own backyard (the Milkyway) derived from chemical abundances of the oldest stars in the Galaxy, and presented tentative evidence for spatial variations in the Initial Mass Function of the Galaxy at early epochs, which has bearing on the temperature variations of the Cosmic Microwave Background.

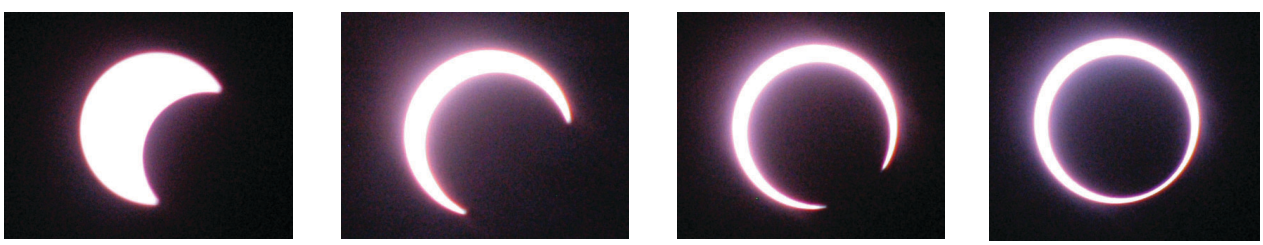
- Sivarani Thirupathi

ग्रहण ! Eclipse !

The Annular Solar Eclipse of January 15, 2010

The 15th of January was an exciting day for astronomy enthusiasts. Thousands of them converged on to the southern parts of India to watch the longest annular solar eclipse of the millenium, which lasted a whole 11-minutes on the cape. Since it occurred around the time that the sun was near zenith, even in areas where the eclipse was only partial, the crescent sun that was clearly visible, and the crescent images that were cast on the ground through nature's pin-hole cameras made by leaves on trees, made for a memorable experience.

On the day of the eclipse, the Moon was 63.4 Earth Radii from us and very close to its apogee, while the Earth had just been a few days past its perihelion. In such an event an unusual view of the eclipsed Sun as a very brightly lit thin rim with a dark central hole (the Moon) is got. The magnitude of the eclipse was 0.918 at the northern tip of the path to about 96% at the central line. The corona of the Sun, which becomes visible during a total solar eclipse such as the one on the 22nd July 2009, is not visible during an annular eclipse because the visible annulus of its disc simply outshines the relatively much feebler corona, which is a million times fainter. At the 15th January eclipse, the path of annularity, over 300 km wide, passed over southernmost parts of India - around Kanyakumari and Adam's Bridge and parts of Tamil Nadu and Sri Lanka. Some major Indian towns that fell within the path of annularity were: Thiruvanthapuram, Nagercoil, Tuticorin, Panakkulam, Madurai, Thanjavur and Rameswaram etc, in order of



वलय सूर्य ग्रहण को क्रमबद्ध तरीके से दिखाती हुई चित्रावली, कन्याकुमारी में भारतीय ताराभौतिकी संस्थान की टीम द्वारा
A montage by the IIA team at Kanyakumari, showing the progress of the annular eclipse.

ग्रहण ! Eclipse !

the passage of the umbra. In the rest of India the eclipse was partial.

The annular phase began at 05:13:54 Universal Time in the Central African Republic and ended on the Chinese Yellow Sea coast at 08:59:01 UT. The maximum eclipse occurred at 07:06:31 UT, with the annular phase lasting over 11 min 08 sec, which is much longer than a total eclipse. This point lay in the Indian Ocean at 1.26N, 68.64E. The northern tip of the path of annularity touched India at 8.801 N, 76.656E, about 10 km south of Kollam and about 2 km south west of Paravur.

Kanyakumari

An eight member team of scientists and students led by Siraj Hasan, Director, IIA, camped at Kanyakumari on the southern tip of the Indian subcontinent, to record the event using digital cameras. Kanyakumari lay about thirty km away from the central line of the annular path. There were passing clouds during the event but it was possible to record the event.

IIA also participated in a national observation camp for school children organised by Vigyan Prasar in collaboration with the Tamilnadu Science and Technology Centre.

Bangalore

While in the Kerala State capital of Thiruvanathapuram which was in the path of annularity, the city corporation ensured that all school children were able to safely watch the annular eclipse, in Bangalore, most schools were declared closed for fear of the eclipse, and the streets of India's silicon valley were deserted. In stark contrast, over 1000 people including children and senior citizens, gathered at the eclipse viewing t organised by the Bharatiya Gyan Vigyan Samiti in collaboration with IIA and the Bangalore Astronomical Society. The IIA Koramangala campus was another rare hub of activity, where over 400 children and adults alike thronged the campus to view the eclipse.

The eclipse in Bangalore was partial. The maximum magnitude of 84.6% was observed at 1:23 pm. As if to compensate for the cloudy skies in Bangalore during the July 2009 eclipse, this time round, the sky offered a clear and spectacular view of the sun. At its Koramangala campus, IIA set up a coelostat system with a 6-inch objective, which projected a foot wide image of the sun on a large white screen to track the progress of the eclipse. Eclipse viewing spectacles were distributed to the public for safety viewing of the phenomenon directly.

At the Malleswaram grounds, there were telescopes that projected the sun's image onto screens, in addition to the protective screens and glasses to view the eclipse directly. While all restaurants and shops had downed their shutters, everyone assembled at the grounds partook in the *Pongal* and sweets that were distributed on the occasion, as was a symbolic rebuttal of the common taboo against eating and drinking during an eclipse, which appears to be practiced even among the educated public. Many rationalists and science activists used the occasion to interact with public to promote a scientific temper and dispel the superstitious beliefs about the eclipse. Ravinder Banyal and P.K.Mahesh from IIA were engaged in many lively discussions with the students and public.

- Ramesh Kapoor, B Ravindra, Ravinder Banyal and Prajval Shastri

कन्याकुमारी में भारतीय ताराभौतिकी संस्थान का ग्रहण प्रेक्षण दल
The IIA Eclipse Team at Kanyakumari.

अपने दूरदर्शी की सहायता से एक पर्दे पर आंशिक सूर्य ग्रहण का बिम्ब प्रक्षेपित करते हुए बेंगलूर एस्ट्रोनॉमिकल सोसाइटी के विवेक अर्कादिताया एवं गौतम

Vivek Erkadithaya and Gautam of the Bangalore Astronomical Society projecting an image of the partial solar eclipse onto a screen using their 8 inch telescope at the Malleswaram grounds.

ग्रहण ! Eclipse !

मल्लेश्वरम् मैदान में आंशिक ग्रहण देखते हुए बेंगलूर के सामान्य जन समूह
The partial eclipse being watched by the public of Bangalore at the Malleswaram Grounds.

आंशिक ग्रहण के अवसर पर मिष्टान्न और पोंगल का सामान्य जन में वितरण
Bangaloreans partake in Pongal and sweets during the partial eclipse!

15 जनवरी, 2010 का वलय सूर्य ग्रहण

खगोल प्रेमियों के लिए 15 जनवरी 2010 का दिन रोमांच भरा था। हज़ारों की संख्या में ये देश के दक्षिणी भागों में दशाब्द के सबसे अधिक काल की वलय स्थिति का ग्रहण देखने के लिए पहुँचे जो केप से देखे जाने पर पूरे 11 मिनट तक रही। चूँकि यह स्थिति तब हुई जब सूर्य आकाश में शीर्ष के पास था, उन इलाकों में भी जहाँ ग्रहण केवल आंशिक था, ग्रस्त सूर्य स्पष्ट रूप से दृष्टि गोचर हुआ और भूमि पर पेड़ों की पत्तियों के प्राकृतिक सूक्ष्म कैमरों के द्वारा ग्रहण के बनाये गये बिम्ब एक अविस्मरणीय अनुभव प्रदान कर गये।

ग्रहण के दिन चंद्रमा हम से 63.4 पृथ्वी व्यासार्ध दूर, अपनी कक्षा में पृथ्वी से दूरतम बिंदु के पास था जब कि कुछ ही दिन पूर्व पृथ्वी अपनी कक्षा में सूर्य से निकटतम बिंदु से गुज़री थी। ऐसी हालत में ग्रसित सूर्य का अनूठा रूप देखने को मिलता है जिसमें सूर्य को एक चमकीले पतले वलय के असाधारण रूप में देख सकते हैं मानो सूर्य के केन्द्र में एक काला छिद्र बन गया हो। वलयाकृति के पथ के उत्तरी छोर पर ग्रहण का परिमाण था 0.918 जो पथ की केन्द्रीय रेखा पर 0.96 तक पहुँचा । ऐसे में सूर्य का किरीट नहीं देखा जा सकता जो पूर्ण सूर्य ग्रहण, यथा 22 जुलाई 2009 के पूर्ण ग्रहण, के समय ही दृष्टिगोचर होता है। सूर्य की वलयाकृति इतनी चमकीली होती है कि सूर्य से 10 लाख गुणा क्षीण किरीट की चमक उसके सामने दब जाती है। 15 जनवरी के

मल्लेश्वरम् मैदान में लोगों के प्रश्नों के उत्तर देते हुए रविन्दर बन्याल (भाताभौ) तथा ई.बसवराजू (बीजीवीएस)
Ravinder Banyal (IIA) and E.Basavaraju (BGVS) fielding questions from the public at Malleswaram grounds.

ग्रहण की वलयाकृति का लगभग 300 कि मी चौड़ा पथ भारत के धुर दक्षिण से गुज़रा-कन्या कुमारी, एडम्स ब्रिज, तमिलनाडु के कुछ भाग एवं श्रीलंका। वलयाकृति पथ की छाया में समयानुसार पड़ने वाले कुछ प्रमुख नगर क्रमश: थे - तिरुवनंतपुरम्, नागरकोइल, टूटिकोरिन, पनाक्कुलम, मदुरै, तंजवुर तथा रामेश्वरम् आदि। देश के शेष भागों में ग्रहण केवल आंशिक था।

वलयाकृति की शुरुआत 05:13:54 UT पर सेन्ट्रल एफ्रिकन रिपब्लिक से हुई जो 08:59:01 UT पर चीन के येलो सी पर ख़त्म हुई। ग्रहण अधिकतम 07:06:31 UT पर हुआ जब वलय स्थिति 11 मिनट 08 सेकण्ड तक रही जो कि किसी भी पूर्ण सूर्य ग्रहण के सापेक्ष बहुत अधिक है। यह

ग्रहण ! Eclipse !

बिन्दु हिन्द महासागर में 1.26 N, 68.64E पर था। भारत में पथ के उत्तरी छोर ने भूमि को 8.801 N, 76.656E पर छुआ जो कोल्लम के 10 किमी दक्षिण में तथा परवूर से 2 किमी दक्षिण पश्चिम में पड़ता है।

कन्याकुमारी

भारतीय ताराभौतिकी संस्थान के 8 – सदस्यीय दल ने निदेशक प्रोफ़ेसर सिराज हसन के नेतृत्व में ग्रहण को डिजिटल कैमरों से रिकार्ड करने के लिए प्रेक्षण स्थल कन्याकुमारी में चुना जो भारत के दक्षिणी छोर पर स्थित है। कन्याकुमारी पथ की केन्द्रीय रेखा से लगभग 30 किमी दूर था। ग्रहण के घटने के दौरान बादल भी आकाश में आये किन्तु ग्रहण की घटना को रिकार्ड किया जा सका।

संस्थान ने तमिलनाडु विज्ञान एवं प्रौद्योगिकी केन्द्र के सहयोग से विज्ञान प्रसार द्वारा स्कूल के बच्चों के लिए संयोजित राष्ट्रीय प्रेक्षण शिविर में भी भाग किया। इस त्रि-दिवसीय शिविर में अपने अध्यापकों के साथ देश के कोने-कोने से लगभग 800 स्कूली बच्चे इकट्ठे हुए जहाँ वैज्ञानिकों के साथ बातचीत, भाषण तथा ग्रहण को सुरक्षित तरीके से देखने पर चर्चा आदि आयोजित हुए। ग्रहण के दिन इसे देखने के लिए केप के सामने समुद्र समक्ष हेलिपैड पर सभी बच्चे, अध्यापक व संसाधन जन एकत्रित हुए। इन के साथ हज़ारों की संख्या में स्थानीय जन, यात्रीगण व दूर-दराज़ से आये ग्रहण-शौक़ीन भी शामिल हुए। वातावरण रोमांच पूरित था, तथा दूसरे सम्पर्क के साथ सूर्य की वलयाकृति के देखे जाने पर एकत्रित समुदाय ने ज़ोर शोर से खुशी प्रकट की। अनेक लोगों ने ग्रहण की प्रगति के चित्र भी खींचे। वलयाकृति के लंबे समय तक रहने के कारण अन्य घटनाओं पर भी ध्यान दिया जा सका, यथा क्षीण प्रकाश का असाधारण रूप, सूक्ष्म कैमरों द्वारा भूमि पर बनाये गये बिम्ब तथा गतिशील बादलों के बीच से झलक दिखाती सूर्य की वलयाकृति। प्रेक्षण शिविर के बच्चों ने अनेक प्रयोग किये जैसे, सूर्य एवं चंद्रमा के कोणीय आकार का मापन, ग्रहण का परिमाण, वनस्पति एवं जीवों पर प्रभाव आदि।

बेंगलूर

जहाँ केरल राज्य की राजधानी तिरुवनंतपुरम् में, जो वलयाकृति पथ में पड़ता था, नगर महापालिका ने सुनिश्चित किया कि सभी स्कूलों के बच्चे सुरक्षित तरीके से वलयाकृति सूर्य ग्रहण को देख पायें, बेंगलूर में अधिकांश विद्यालयों ने ग्रहण के डर से छुट्टी की घोषणा कर दी और भारत की सिलिकॉन घाटी की गलियाँ वीरान हो गयीं। इसके विपरीत संस्थान एवं बेंगलूर एस्ट्रोनॉमिकल सोसाइटी के सहयोग से भारतीय ज्ञान विज्ञान समिति द्वारा आयोजित आँशिक ग्रहण दर्शन के लिए 1000 से अधिक छात्र , वरिष्ठ नागरिक एवं अन्य मल्लेश्वरम् के मैदान में एकत्रित हुए। संस्थान का कोरमंगला परिसर सक्रियता का दूसरा दुर्लभ केन्द्र बना जहाँ 400 से अधिक बच्चों व बड़ों ने परिसर में आकर आँशिक ग्रहण का नज़ारा किया।

बेंगलूर में ग्रहण आँशिक था। उस दिन दोपहर 1:23 बजे ग्रहण का अधिकतम परिमाण 84.6% देखा गया। मानो जुलाई 2009 के पूर्ण सूर्य ग्रहण के समय मेघाच्छादित आकाश के लिए क्षति पूर्ति करने हेतु, 15 जनवरी के दिन बेंगलूर का आकाश साफ़ था जिसने सूर्य का एक दर्शनीय रूप प्रस्तुत किया। कोरमंगला परिसर में संस्थान ने 15 सेमी अभिदृश्यक के साथ एक सीलोस्टैट प्रणाली स्थापित की जिससे एक बड़े पर्दे पर सूर्य का लगभग 30 सेमी आकार का बिम्ब प्रक्षेपित किया गया और ग्रहण की प्रगति दिखाई जा सकी। उपस्थित लोगों को ग्रहण सुरक्षित ढंग से देखने के लिए ग्रहण दर्शी चश्मे भी वितरित किये गये।

मल्लेश्वरम् मैदान में सुरक्षात्मक पर्दों व चश्मों के वितरण के अतिरिक्त दूरदर्शियों के ज़रिये पर्दों पर सूर्य के बिम्ब प्रक्षेपित किये गये। सभी रेस्तरों एवं दुकानों ने अपने शटर गिरा दिये किन्तु मैदान में सभी ने पोंगल एवं मिष्टान्न का स्वाद लिया जो ग्रहण के समय कुछ भी न खाने पीने की उस सामान्य वर्जना का प्रतिकार था जिससे आज शिक्षित लोग भी अछूते नहीं। अनेक बुद्धिवादियों व विज्ञान प्रचारकों ने इस अवसर पर लोगों से चर्चा की व उन्हें वैज्ञानिक मन:स्थिति बनाने का आह्वान एवं अन्धविश्वासों को दूर करने का प्रयास किया। छात्रों व अन्य लोगों के साथ संस्थान के पी.के.महेश एवं रविन्दर बन्याल ने ग्रहण संबंधी वैज्ञानिक चर्चा की।

-रमेश कपूर, वी.रवीन्द्रा, रविन्दर बन्याल एवं प्रज्वल शास्त्री

National Science Day

The new Skywatch Observatory on the terrace of IIA's main building, which houses a 14" telescope. Amar Sharma from the Bangalore Astronomical Society is seen explaining a point to interested viewers on the National Science Day.

The National Science Day celebrations at IIA this year were spread over three days, starting on the 26th February, 2010. A highlight of the celebrations was the inauguration of IIA's Skywatch Observatory, by Siraj Hasan, Director, IIA. Located on the 5th floor terrace of the main building in the Bangalore campus, this 14" reflecting telescope, with electronic tracking, is housed in a protective dome that was fabricated at IIA. It is easy to use, and is meant to facilitate regular sky-viewing opportunities for the public.

On the following day, the 27th February, about 200 school children from the Government High School, Madivaala (with whom IIA has had an extension programme for about two years) and Chinmaya Vidyalaya, Koramangala, listened to lectures by IIA scientists. They heard S.P.Rajaguru speak on the Sun, Ravinder Banyal on *Light: A Cosmic Messenger,* and Margarita Safonova on *Space astronomy.* P.K.Mahesh conducted a sun-viewing programme.

The first public sky-watch with the newly inaugurated facility occurred on Science Day, the 28th February 2010. The event, conducted mainly by the students of IIA in collaboration with the Bangalore Astronomical Society, drew a large participation from the enthusiastic public. About 150 people visited the IIA for this event and were introduced to the night sky. The occasion was also used to demonstrate the use of IIA's 4" Galileoscope, a low-cost telescope that IIA designed on the occasion of the International Year of Astronomy, 2009, and which has been distributed to over 400 interested groups and individuals.

An enthusiastic public watch the night sky from IIA's terrace. One of them is seen peeking through IIA's 4" Galileoscope in the foreground, while others queue up to look through the 14" telescope.

- Ravinder Banyal & Sabyasachi Chatterjee

J. T. M. Gibson Award

Siraj Hasan received the J.T.M. Gibson Award for Excellence from the Maharaja Gaj Singh of Jodhpur at a ceremony on the 21st February, 2010 in Mayo College, Ajmer. The award was instituted in the memory of Jack Gibson, former principal of the College, and is given to alumni who have made a difference to society.

Siraj Hasan receiving the JTM Gibson Award for Excellence at Mayo college.

Farewell

IIA wishes all the best to ...

...Mr C. Sivathan, who served the IIA security at the Vainu Bappu Observatory, Kavalur, as a supporting staff, since 1980 retired on December 31, 2009.

...Mr C. Krishnamoorthy served in the Laboratory of the Vainu Bappu Observatory, at Kavalur, since January 25th 1989 and retired on December 31, 2009.

...Mr B. Kuppuswamy who served the IIA support staff since 7th March 1978 retired on December 31, 2009.

... R. Surendiranath joined IIA on 22nd March 1978 and continued his research career there till his superannuation on January 31, 2010. It is here at IIA he wrote a new photoionization model code and applied the same to a WC11 type planetary nebula. This work earned him the doctoral degree from the Bangalore University. The opportunity to do state-of-art work came to him when he applied the fully bench-marked plasma code "CLOUDY" to model several planetary nebulae and challenge these models with multi-wavelength observations. With these he could demonstrate how accurate chemical abundances could be derived and also use the models to self-consistently derive the various physical parameters of the central stars. He introduced for the first time an "End-to-End Model" of a planetary nebula wherein he combined a photoionization model with a photodissociation model in a single structure. This was a unique feat and a path-breaker in the field of modeling. Currently he continues in IIA as a Visiting Professor working on his latest projects.

The 3rd IIA-PennState Astrostatistics School

The Indian Institute of Astrophysics and the Center for Astrostatistics, Pennsylvania State University (USA) are jointly organising an 8-day school in fundamental statistical inference as applicable to astrophysical problems for practising astrophysicists of all levels, during 19th-27th July, 2010, at the Vainu Bappu Observatory, IIA, Kavalur. The deadline to receive applications is the 15th April, 2010. Details and the on-line application form are available on the website: ***www.iiap.res.in***.

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.

Editors: Prajval Shastri, Sandra Rajiva and S. P. Rajaguru
Editorial Assistance : Purushotham Masuna
Photo Credits: T. K. Muralidas, R. Banyal, Bangalore Astronomical Society, Bharatiya Gyan Vigyan Samiti and Mayo College

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