आईआईए न्यूज़लेटर

# IIA Newsletter

खण्ड 16 सं 2 | भारतीय ताराभौतिकी संस्थान | जून 2011

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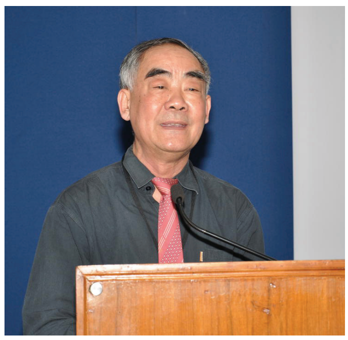
## In this issue...



## 3rd Indo-China Workshop on Solar Physics and 1st Asia-Pacific Solar Physics Meeting

*Professor Jingxiu Wang (National Astronomical Observatories, China) lighting the lamp at the inaugural session of the meeting.Others present here (from the left) are, Professors Cheng Fang, Arnab Rai Choudhuri, Siraj S. Hasan (Director, IIA) and Takashi Sakurai(NAOJ, Japan).*

The 3rd Indo-China Workshop on Solar Physics was organized by the Indian Institute of Astrophysics at its Bangalore campus on the 21st of March, 2011. This was sponsored by a bilateral exchange programme of the Department of Science and Technology (India) and the National Science Foundation of China. This time, with the initiatives of leading solar physicists in India, the DST also approved, with some financial support, enlarging the scope of the meeting by inviting solar physicists from other asian countries with the aim of fostering cooperation and collaboration in solar physics within the Asia-Pacific region. This facilitated organizing the 1st Asia-Pacific Solar Physics Meeting, which followed first day's sessions on Indo-China Workshop and occupied the days 22 - 24 March, 2011. A major part of the India-China discussion session included scientific presentations by leading Indian and Chinese solar physicists on their



*Professor Jingxiu Wang presenting a science talk during.the Indo-China discussion session.*

*Prof essor Cheng Fang makes opening remarks during the inaugural session of the meeting.*

*Professor Cheng Fang presenting a momento to Professor S.S. Hasan, Director of IIA, on behalf of the visiting Chinese delegation.*

respective observational facilities and research programmes in solar physics. This included discussions on their respective planned facilities for the near future. Results from existing facilities were presented and discussed.

The overall structure of the meeting was in the format of 30 minute invited talks and 20 minute shorter contributed talks along with extended poster sessions. The opening remarks of the meeting was by Cheng Fang (Nanjing University, China), who was also a co-chair of the scientific organizing committee of the meeting. The inaugural talk on *The First Four Years of Hinode* was given by Takashi Sakurai of NAOJ, Japan.Following the first day's India-China session, the meeting had the following sessions: *Solar Interior to the Solar Surface*, *Solar Surface, Active Regions and Magnetic Fields above them*, *Corona and the Solar Wind*. In addition, one of the evenings was dedicated for a session on history and reminiscences on solar physics in the Asia-Pacific region. Senior scientists from India and China also had an interactive session in the form of a group discussion for future collaborations. It was also decided to bring-out a conference proceedings which will be published as a special volume in the Bulletin of Astronomical Society of India Conference Series (ASICS). Arnab Rai Choudhuri is a lead editor of the proceedings volume, and he also contributed immensely, as a member of both the SOC and LOC, to the overall organization of the meeting.There were 132 participants from India, China, Japan, South Korea, Australia,Siberian Russia and also included scientists of Asia-Pacific origin but working elsewhere across the world. The out-station participants were accommodated in local hotels, guest house of nearby St.Johns Medical College and IIA guest house.

*- S.P. Rajaguru & D. Banerjee*

*Professor Arnab Rai Choudhuri briefing the participants on the organisational details of the meeting.*

*Participants during one of several poster sessions, which were given ample time to enable detailed discussions and interactions.*

## National Meeting on Space Weather

*Professor Archana Bhattacharyya, Emeritus Scientist, IIG, Mumbai speaking on'Impact of solar disturbances on Earth's magnetosphere and ionosphere'.*

*Professor Nat Gopalswamy, from NASA Goddard Space Flight Center, speaking on the 'International Space Weather Intitiative'.*

A one-day national meeting to discuss *Solar Dynamical Processes as Drivers of Space Weather* was organized at IIA, Bangalore, immediately following the 3rd Indo-China and 1st Asia-Pacific Solar Physics Meeting, on the 25th of March, 2011. This meeting made use of the availability of many Indian solar physicists who participated in the preceding meeting, and also had geophysicists and researchers from the field of planetary physics from the Indian Institute of Geomagnetism (IIG), Mumbai and Physical Research Laboratory (PRL), Ahmedabad. Archana Bhattacharyya, Emeritus Scientist, IIG and S.S. Hasan, Director of IIA, presided over the meeting. This meeting had focussed discussions on the underlying connection between processes in the solar interior and atmosphere and their influence on space weather. Topics covered included solar activity, and their impact on the interplanetary medium, magnetosphere, ionosphere and the Earth's atmosphere.The speakers included Nat Gopalswamy (NASA), P.K. Manoharan (TIFR, Ooty), D. Pallamraju (PRL, Ahmedabad),Archana Bhattacharyya (IIG, Goa), S.P. Rajaguru (IIA), D. Banerjee (IIA), and R. Ramesh (PRL, Ahmedabad). This session was organized as a precursor to the International Space Weather Initiative (ISWI), a follow-up program of the successful "International Heliophysical Year (IHY) 2007" programme.

*- S. P. Rajaguru*

## In-House Scientific Meeting, 2011

The In-House Scientific Meeting was held at IIA on 18th April, 2011. There were 22 scientific talks and 8 posters, covering areas of solar physics, stars, galaxies, theoretical astrophysics, fundamental physics and astronomical instrumentation. The winners of the outstanding Research paper award for the year 2011 were L. S. Anusha et al., A. Goswami et al.and R. Ramesh et al.. The details of the papers are as follows:

*Winners of Outstanding Research Paper Award, L.S. Anusha, R. Ramesh and A. Goswami with S. S. Hasan, Director, IIA.*

Anusha, L.S., Nagendra, K. N., 2011, *Polarized Line Formation in Multi-Dimensional Media. I. Decomposition of Stokes Parameters in Arbitrary Geometries*, ApJ, 726, 6.

Goswami, Aruna, Karinkuzhi, Drisya, Shantikumar, N. S., *HE 1015-2050: Discovery of a HydrogenDeficient Carbon Star at High Galactic Latitude,* 2010, ApJ Lett, 723, 238.

Ramesh, R., Kathiravan, C., Narayanan, A.S. 2011,*Low-frequency Observations of Polarized Emission from Long-lived Non-thermal Radio Sources in the Solar Corona,* ApJ, 734, 39.

*- T. Sivarani*

## Optical studies of SN 2009jf : A type Ib supernova with an extremely slow decline and aspherical

Type Ib supernovae (SNe Ib) are core-collapse supernovae characterized by the presence of prominent helium lines and the absence of hydrogen lines. They are believed to be the results of violent explosions of massive stars such as the Wolf-Rayet stars, which are stripped off most or all of their hydrogen envelope, either by mass transfer to a companion, or via strong winds, or by sudden eruptions. These supernovae are also termed as stripped-envelope supernovae.

SN 2009jf was discovered in the spiral galaxy NGC 7479. Early spectra indicated the supernova to be of type Ib. Optical photometric and medium resolution spectroscopic observations of the supernova were obtained during the period -15 to +250 days with respect to the B-band maximum, using the 2m HCT. With an absolute magnitude of $M_V = -17.96 \pm 0.19$ mag at peak, SN 2009jf is a type Ib of normal brightness. The slower initial rise to maximum and post maximum decline of the light curves in comparasion with other Ib supernovae, makes the light curves of SN 2009jf broader (Figure1). The broader light curves and slower decline rates suggest that the ejecta of SN 2009jf is relatively efficient in trapping the gamma rays produced in the radioactive decay, and the progenitor was able to retain more envelope prior to the core-collapse, thus increasing the diffusion time. The peak bolometric luminosity and the energy deposition rate via $^{56}$Ni chain to $^{56}$Co chain indicate that ~0.17 $M_\odot$ of $^{56}$Ni was ejected during the explosion (Figure 2).

The spectral evolution is shown in Figure 3. Our first spectrum is one of the earliest spectrum for type Ib supernovae. The spectral evolution of SN 2009jf is typical of type Ib class. He I 5876 Å is clearly identified in the first spectrum obtained 15 days before maximum, at a velocity of ~16000 km/sec. This early emergence of helium lines is likely due to a substantial mixing of the inner layers of the ejecta. The [OI] 6300 - 6364 Å line seen in the nebular spectrum is multi-peaked and asymmetric, with a sharp, stronger blue peak. This is explained by the complex ejecta structure of an aspherical explosion. The absolute flux of this line indicates the mass of oxygen ejected during the explosion to be 1.34 $M_\odot$.

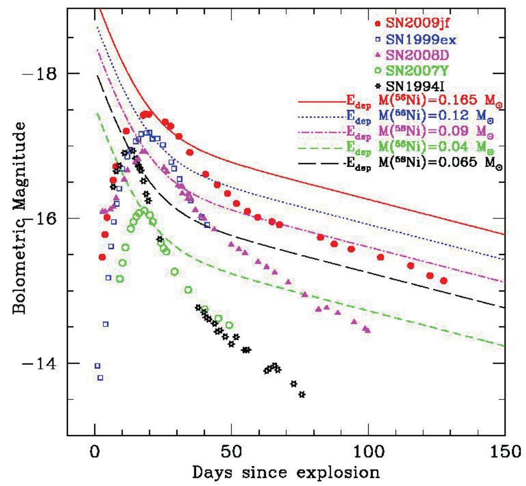



*Figure 2. Bolometric light curves of SN 2009jf and other type Ib/c supernovae.The continuous curves correspond to the rate of energy production for different masses of $^{56}$Ni synthesized during the explosion.*

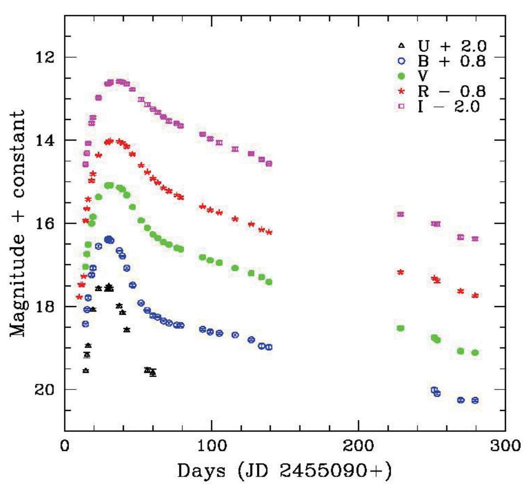



*Figure 1. UBVRI light curves of SN 2009jf. The light curves have been shifted by the amount indicated in the legend.*

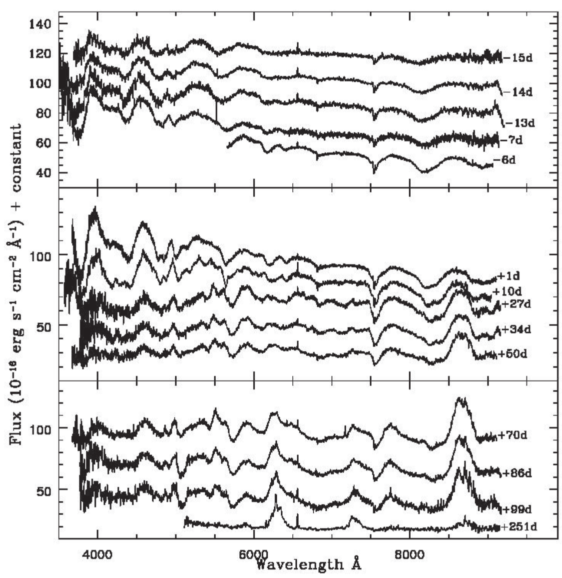



*Figure 3. Spectral evolution of SN 2009jf.*

The slow evolution of the light curves of SN 2009jf indicates the presence of a massive ejecta. The high expansion velocity in the early phase and broader emission lines during the nebular phase suggest it to be an explosion with a large kinetic energy. A qualitative analysis of the light curve and spectra of SN 2009jf indicates that the mass of the ejecta and kinetic energy of explosion are $M_{ej}$= 4 - 9 $M_{\odot}$ and $K_E$= 3 - 8 x $10^{51}$ erg, respectively. The main sequence mass of the progenitor star is estimated to be > 20 - 25 $M_{\odot}$. *This work has been published in 2011, MNRAS, 413, 2583.*

*- D. K. Sahu, U. K. Gurugubelli, G. C. Anupama, & K. Nomoto*

## Magnetic Field Structure of Mercury

Observations from the Mariner and recent MESSENGER experiments show that Mercury inherits a weak (~ 300 nano Tesla) and predominantly largescale, dipole-like magnetic field structure that is aligned with the rotational axis. One way to explain such a stationary and large-scale magnetic field structure is invoking of well known *convective dynamo mechanism* (Christensen et al.2009) that is used for the explanation of magnetic field structure of other planets. For explanation of proper geometry and sustenance of magnetic field structure of a planet, main ingredients of the *convective dynamo mechanism* are that planet's interior structure must be either fully or partially convective and rotate fast such that magnitudes of magnetic (Lorentz) and Coriolis forces are of similar order. That is, the ratio of Lorentz to Coriolis force, called the Elsasser number $\lambda$, must be order of unity. On the other hand, Mercury rotates so slow (~ 59 days) that Elsasser number turns out to be $\sim 10^{-4}$. Moreover, Mercury's thermal evolutionary models further explored the conditions under which excess entropy is available to drive a convective dynamo and came to the conclusion that present-day dynamo is difficult to achieve. In addition, due to giant impacts in the early evolutionary history of the solar system, it is not clear whether such a dynamo mechanism survives or not. Recently, it is proposed that Mercury's large-scale weak magnetic field structure is the result of internal weak dynamo mechanism sustained by the magnetospheric currents due to a strong solar wind in the early history of the solar system formation. However, according to Heyner et al. (2011), such a feedback mechanism works only for a narrow range of dynamo numbers in the case of Mercury.

Could the largescale magnetic field structure of Mercury be of primordial origin that pervades the entire dimension of the planet such that diffusion timescale of the magnetic field structure is comparable to or greater than the age of the planet? In case such a magnetic field structure is of primordial origin, as the internal temperature structure of the iron core of Mercury is above the Curie temperature, how to reconcile with the experimental evidence that magnetic field structure must be non-existent and the observations show other way. In the present study, these questions are addressed and explored further and shown with affirmative that Mercury's magnetic field structure is likely to be of primordial origin that might have been inherited from the early history of solar system formation.

With the observed constraint of Mercury's atmospheric magnetic field structure, internal magnetic field structure is obtained as a solution of magnetic diffusion equation. In this study, Mercury's internal structure mainly consists of a stably stratified fluid core and the convective mantle. For simplicity, magnetic diffusivity in both parts of the structure is considered to be uniform and constant with a value represented by suitable averages. It is further assumed that vigorous convection in the mantle disposes of the electric currents leading to a very high diffusivity in that region. Thus, in order to satisfy observed atmospheric magnetic field structure, Mercury's most likely magnetic field structure consists of a solution of MHD diffusion equation in the core and a combined multipolar (dipole and quadrupole like magnetic field structures embedded in the uniform field) solution of a current free like magnetic field structure in the mantle and in the atmosphere.With imposition of appropriate boundary conditions at the core-mantle boundary for the first two diffusion eigen modes, in order to satisfy the observed field structure, present study puts the constraint on Mercury's core radius to be ~ 2000 km. From the estimated magnetic diffusivity and the core radius, it is also possible to estimate the two diffusion eigen modes with their diffusion timescales of the ~ 8.6 and 3.7 billion yrs respectively suggesting that the planet inherits its present day magnetic field structure from the solar nebula. It is proposed that permanency of such a largescale magnetic field structure of the planet is attained during Mercury's early evolutionary history of heavy bombardments by the asteroids and comets supporting the giant impact hypothesis for the formation of Mercury. *This research work is accepted by Planetary and Space Science and details can be obtained either from the IIA repository (http://prints.iiap.res.in/handle/2248/5467) or from the journal website.*

**References :**

(1) Christensen, U. R., Schmitt, D., Rempel, M., 2009, Space Sci. Revi.,144, 105

(2) Heyner, D., Schmitt, D., Glassmeier, K.-H., Wicht, J., 2011, Astr. Nach.,, 332, 36

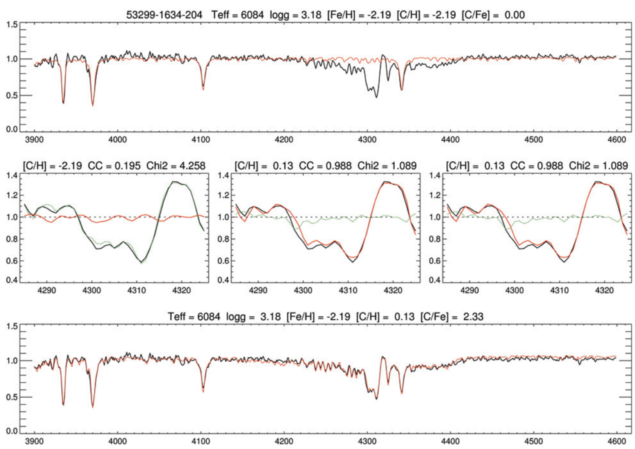
*- K. M. Hiremath*

## Carbon in the Early Galaxy

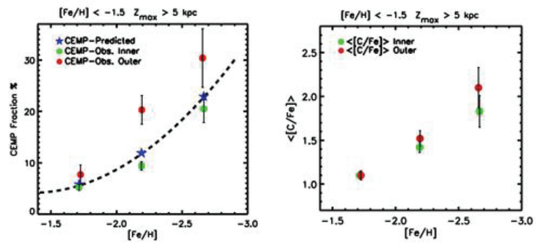
This work was motivated by the recent observations, indicating copious amount of carbon in the early epochs of Galaxy formation.The increase in carbon abundances are observed, in the Milkyway metal poor stars as well as at high redshifts(in the IGM and quasar absorption lines). Possible implication of these observations could be, change in the early IMF (intial Mass Function) with characteristic masses around intermediate mass stars, which would evolve into AGB stars.There were also suggestions by the Geneva group for carbon production due to metal poor fast rotating massive star winds.

We derived carbon abundances for 300,000 stars from the Sloan Digital Sky Survey (SDSS) stars. For a subsample of 30,000 calibration stars (which has a well understood target selection throughout the SDSS survey), we derive the kinematic and orbital parameters. 'Carbonicity' (stars with carbon in excess of [C/Fe] > 0.7), at various metallicities and at various vertical distances from the Galactic plane are estimated.The global frequency of CEMP (Carbon enhanced meta poor) stars in the halo increases from 8% for [Fe/H] < -1.5 to 20% for [Fe/H] < -2.5. We also confirm a significant increase in the level of carbon enrichment with declining metallicity, going from [C/Fe] = +1.0 at [Fe/H] = -1.5 to +1.7 at [Fe/H] = -2.7.

Based on a statistical separation of the halo components in velocity space, we find evidence for a significant contrast in the frequency of CEMP stars between the inner- and outer-halo components. The outer halo possesses roughly twice the fraction of CEMP stars as the inner halo. The carbonicity distribution also differs between the inner-halo and outer-halo components. The inner-halo has a greater




*The figure shows an example of the automated fitting procedure, used to derive the carbon abundances.The top panel shows the fit for the intial guess value [C/Fe]=0.0 (solar value).The bottom panel is the fit for the derived [C/Fe] value.*




*Left panel: Global trend of the CEMP star fraction as a function of the metallicity, and for the low-metallcity stars of the Extended Sample with Zmax > 5 kpc. The dashed curve is the second-order polynomial fit representing the global trend. Right panel: Global trend of the mean carbonicity, [C/Fe] , as a function of [Fe/H]. only those stars with detected CH G-bands are used. No significant difference is seen for the inner and outer halo subsamples.*

portion of stars with modest carbon enhancement ([C/Fe] = +0.5]; the outer-halo has a greater portion of stars with large enhancements ([C/Fe] = +2.0), although considerable overlap still exists.

The large fractions of CEMP stars in both halo components indicates that significant amounts of carbon were produced in the early stages of chemical evolution in the Universe.The observed contrast of CEMP star fractions in the inner- and outer halo strengthen the picture that the halo components had different origins, and supports a scenario in which the outer-halo component has been assembled by the accretion of small subsystems. In this regard, it is interesting that the MDF (Metallicity Distribution function) of the inner halo (peak at [Fe/H] = -1.6) is in the metallicity regime associated with the CEMP-s (CEMP stars with s-process enhancement) stars, which are primarily found with [Fe/H] > -2.5, while the MDF of the outer halo (peak at [Fe/H] = -2.2), might be associated with the metallicity regime of the CEMP-no stars, which are primarily found with [Fe/H] < -2.5.

The fact that, in the metal-poor regime, the outer halo exhibits a fraction of CEMP stars that is larger than the inner halo (CEMP outer = 2 CEMP inner ), suggests that multiple sources of carbon, besides the nucleosynthesis of AGB stars in binary systems, were present in the pristine environment of the outer-halo progenitors (lower mass sub-halos). These sources could be the fast massive rotators and/or the faint supernovae or possibility that primordial gas was pre-enriched in heavy metals by less massive SNe ($13 < M/M_\odot < 30$), whose ejecta underwent substantial mixing and fallback, while the C (and N, O) originated from massive rotating stars with $M = 40\ M_\odot$. If the CEMP stars in the outer halo are predominantly CEMP-no stars (which has yet to be established), it might suggest that non-AGB-related carbon production took place in the primordial mini-halos. These results will be published in ApJ (http://arxiv.org/abs/1103.3067).

- T. Sivarani, D. Carollo, T. C. Beers

## Publications

**March - May 2011*@**

(1) Javaraiah, J., 2011, Solar Physics 270, 463 - 483 *Long-Term Variations in the Growth and Decay Rates of Sunspot Groups*

(2) Stalin, C. S., Jeyakumar, S., *Coziol, R., *Pawase, R. S., *Thakur, S. S., 2011, MNRAS 913 *Mass of the Black Hole in the Seyfert 1.5 Galaxy H 0507+164 from Reverberation Mapping. MNRAS 913*

(3)*Meech,K.J., * A'Hearn, M.F, 196 Coauthors **...** Bhatt, B. C., D.K. Sahu 2011, ApJ, 173,L1 *EPOXI: Comet 103P/Hartley 2 Observations from a Worldwide Campaign.*

(4)Ramesh, R., Kathiravan, C., *Narayanan, A. S. 2011, ApJ, 734, 39 *Low-frequency Observations of Polarized Emission from Long-Lived Non-thermal Radio Sources in the Solar Corona*

(5) Murthy, J., *Conn Henry, R. 2011 ApJ 734, 13 *Dust-scattered Ultraviolet Halos around Bright Stars*

(6) Sivaram, C., *Arun, K., *Nagaraja, R. 2011, ApSS, 227 *Dieterici Gas as a Unified Model for Dark Matter and Dark Energy*

(7) *Bianda, M., *Ramelli, R., Anusha, L.S., *Stenflo, J.O., Nagendra, K. N., *Holzreuter, R., Sampoorna, M., *Frisch, H., Smitha, H. N. 2011,A&A, 530, L13 *Observations of the Forward Scattering Hanle Effect in the Ca I 4227A Line*

(8) Dhar, A., *Mishra, T., *Pai, R. V., Das, B. P., 2011, Phys. Review A, 83, No. 5, 053621 *Quantum Phases of Ultracold Bosonic Atoms in a One-Dimensional Optical Superlattice*

(9) *Belton, M. J. S., and 70 coauthors **...** Bhatt, B. C., Sahu, D. K., 2011, Icarus 213, 345 - 368 *Stardust-NExT, Deep Impact, and the Accelerating Spin of 9P/Tempel 1*

(10) *Meech, K. J., and 57 coauthors ... Bhatt, B. C., and D.K.Sahu 2011, Icarus 213, 323 *Deep Impact, Stardust-NExT and the Behavior of Comet 9P/Tempel 1 from 1997 to 2010*

(11) Smitha, H. N., Sampoorna, M., Nagendra, K.N., *Stenflo, J.O. 2011, ApJ, 733, 4 *Polarized Line Formation with J-state Interference in the Presence of Magnetic Fields. I. Partial Frequency Redistribution in the Collisionless Regime*

(12) Sivaram, C., *Kenath, A., *Nagaraja, R., 2011, ApSS, 333, 1 - 2 *A Critique on Drexler Dark Matter*

(13) *Wiita, P. J., *Goyal, A., *Krishna, G., Anupama, G. C., Sahu, D. K., *Joshi, S., *Karthick, C., Sagar, R., 2011, BAAS, #327.03 *Intranight Optical Variability of Core Dominated Quasars and TeV Blazars*

(14) *Pathak, A., Pradhan, A.C., *Sujatha, N.V., Murthy, J. 2011, MNRAS, 412, 1105 -1122 *Survey of O VI Absorption in the Large Magellanic Cloud*

(15) Anathpindika, S., Bhatt, H. C., 2011, MNRAS, 412, 921 - 934 *On the interaction of a Thin, Supersonic Shell with a Molecular Cloud*

(16)*Bayanna, A.R.,*Mathew,, ApJSS,193, 29, ApJSS,193,29,ApJSS,193,29S. K.,*Sankarasubramanian, K., *Venkatakrishnan, P., Singh, J., Prasad, B. R., 2011., Experimental Astr., 29, 145 - 153 *Issues with External Occultation of a Coronagraph*

(17) Aihara, H., and 179 coauthors **...** T. Sivarani 2011, ApJSS,193, 29 *The Eighth Data Release of the Sloan Digital Sky Survey: First Data from SDSS-III*

(18) *Lal, D.V., Shastri, P., *Gabuzda, D.C., 2011, ApJ, 731, 68 *Seyfert Galaxies: Nuclear Radio Structure and Unification.*

(19) Kathiravan, C., Ramesh, R., *Barve, I.V., *Rajalingam, M., 2011, ApJ, 730, 91 *Radio Observations of the Solar Corona During an Eclipse.*

(20) Krishna Prasad, S., Banerjee, D., Gupta, G.R., 2011 A&A, 528, L4 *Propagating Intensity Disturbances in Polar Corona as seen from AIA/SDO.*

(21) Sampoorna, M., 2011, ApJ, 731, 114 *m-state Interference with Partial Frequency Redistribution for Polarized Line Formation in Arbitrary Magnetic Fields*

***Collaborator, @IIA Repository**

An essay by C. Sivaram on **Hydrodynamics, Horizon, Holography and Black Hole Entropy** was selected for **Honorable Mention** by the Gravity Research Foundation, Massachusetts, USA for the year 2011.

## HCT Completed Ten Years


*HCT completed 10 years since its installation on Digpa Rasta Ri on 26th September, 2010*

HCT completed ten years since its installation in August 2000, and nearly eight years since its remote utilization from CREST campus with all the first generation instruments available to astronomers through competitive time allocation. The total number of research papers published during this period was 85, apart from papers presented at conferences.

*- T. P. Prabhu*

## New Computer Facilities at IIA

The computer facilities at IIA has always been individual based, where most of the academic members of the Institute use their own workstations for complete computing needs. In the recent times, there has been a rising demand for larger memory, higher processing and storage that are beyond the limits of conventional workstations. The new data center is expected to satisfy this rising demand for computing power and storage.

A new 20 node high performance computing cluster with a peak performance of around 5.8 TFlops is presently being configured in the data center. Based on Xeon X5675 processors, this new HPC cluster supports 24 logical

*The newly set-up Data Center at IIA that houses all the computing, web and email servers of IIA*

processing cores and 96 GB DDR3 memory per node. Interconnect is through Infiniband QDR (40Gb/s). A GPU computing server based on nVidia Fermi C2070 GPU cards, with a peak floating point performance of 2.6 T Flops is already operational. Apart from these, a new data processing server with dual AMD Opteron 6176SE 12-core processor and 32GB DDR3 memory is also available for memory intensive data processing requirements. On the storage front, a new 12TB IP-SAN disk server is now operational and will be upgraded to 36TB in the near future.The 20 node cluster has an associated storage module of 48TB raw disk space. These are new additions, alongside the existing 10TB disk server.

IIA has always been a source of astronomical data. The new data center will host data from Institute's observatories. Starting with the 100+ years of digitized solar images from Kodaikanal Solar Observatory to the optical telescopes and upcoming space astronomy missions, all data will be made available through the data center. Work is in progress to prepare a common interface to provide access to these data.

Internet bandwidth has been upgraded recently to 25 Mbps. A secondary internet link from National Knowledge Network (NKN) is functional now and it offers a total bandwidth of 1 Gbps, shared by various research institutes in Bangalore. Institute's LAN is being upgraded to a new 1 Gbps high speed network infrastructure. Field stations at Gauribidanur, CREST and Kodaikanal are now part of main campusLAN via MPLS network.
Ph. D AwardedPh. D Awarded

*- Dipankar Banerjee*

## *Ph. D. Awarded*

**Girjesh R. Gupta** has been awarded the Ph.D. degree in Physics, for his thesis titled ***On the Nature of Propagating MHD Waves in the Solar Atmosphere***, by the Indian Institute of Science in May 2011. He was guided by *Dipankar Banerjee*. Gupta will be taking up the post-doctoral position at the Max Planck Institute of Solar System Research, Katlenburg-Lindau, Germany in August 2011.

## Pioneers of Telescopic Astronomy in India: G.V.Juggarow and His Observatory

G.V. Juggarow: Gode Venkata Jugga Row was one of the early pioneers of observational astronomy in India, who built his own observatory in 1841 at Vizagapatnam. He got himself educated for a few years at Madras Observatory in mathematics by the then Government Astronomer T.G. Taylor, where he got the taste to work in Astronomy. This inspiration led him to build his own observatory at Vizagapatnam when he returned back to his native place. What is remarkable about Jugga Row Observatory is that, it functioned until about 1912 over seven decades, where as two other contemporary observatories established by Nawab of Oudh, King Nasiruddin Hyder at Lucknow in 1832 and by Raja of Travancore, Rama Vurmah at Trivandrum in 1836 at the behest of British Surveyor/astronomers (advisers) could not survive for more than a decade. It was also the first observatory in India which started systematic photographic observations of the sky.

G.V. Jugga Row was born in 1817 into a rich and well educated zamindari family in Vizagapatnam. He got his early education at Vizagapatnam and had good aptitude in mathematics. Keeping up his family tradition, he was induced to place himself under the tuition of Mr.Taylor of Madras Observatory, when he was 17 years of age. At Madras Jugga Row worked on astronomical topics and wrote papers regarding mass of planet Jupiter[1] and computed ephemeris of Comet Halley[2] for 1836 based on the orbital elements calculated by Taylor, so as to observe it at Madras in later months. Morris[3], the then editor of Madras Journal of Literature and Science had considerable praise for Jugga Row and he says (G.V.J.), promises to be a distinguished instrument in the good work of elevating the people of India from the Character for indifference to intellectual acquirements ... Providence has blessed him with excellent talents, and has placed him in a station of life where his example will have great influence, it is his bounden duty to do all in his power for the promotion of education among his country men, with a view of elevating them as a people in the moral and intellectual scale. According to Francis[4] (1915- Vizagapatnam, District Gazetteers) Jugga Row was on one occasion recommended to act for Mr.Taylor which is a measure of young Jugga Row's abilities.

Back at Vizagapatnam, Jugga Row started his observatory at his own residence at Daba Gardens in 1841 (Figure.1) to conduct both astronomical and meteorological observations. He also procured a 4.8 inch aperture 5.67 feet focal length telescope from W.S.Jones of London with eye pieces of various magnifications ranging from 40 to 300. However he did not live long enough to see the optics to arrive and be fully assembled into a telescope. He died in 1856 at the age of 39. He also invented a splendid rain gauge (Pluviometer), constructed Anemoscope and thermometers with dry and wet bulbs. He was also instrumental in displaying for public, time signals on a flag staff erected on Dolphin's nose hill.

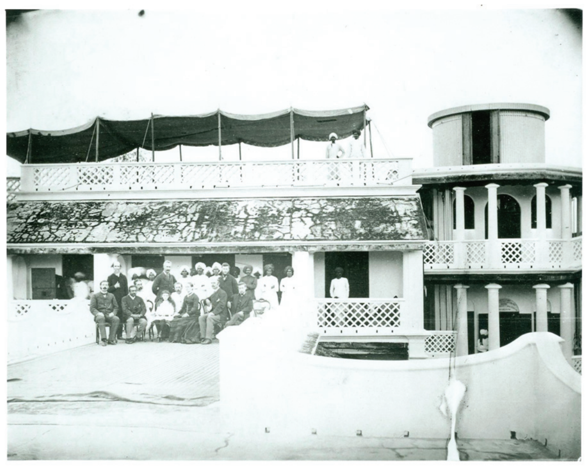


*Figure1. The G. V. Juggarow Observatory as seen in 1874 on the occasion of transit of Venus. The assembled gathering to witness the event can also be seen. A. V. Nursing Row was also present. (Courtesy: Royal Astronomical Society.)*

A.V. Nursing Row: After Jugga Row's death A.V.Nursing Row (Figure.2), his son-in-law took over the observatory and refurbished it with other instruments and a dome. He assembled the 4.8 inch telescope and started using it in a regular fashion. The early observations at Jugga Row observatory seem to consists of making observations with Troughton's transit circle as well as providing time signals on the Flag staff at Dolphin's Nose.

*Figure 2. A. V. Nursing Row who essentially equipped, maintained and conducted observations at the observatory until his death in 1892.(www.avncollege.ac.in/aboutus/history.html, 2010).*

The first published account of the observatory's scientific activities was described in a pamphlet brought out by Nursing Row on the occasion of the famous solar eclipse of 16 August 1868, which was partial at Vizagapatam. He got a telescope of 4.8 inch aperture, whose optics was earlier procured by G. V. Juggarow, made ready in his own workshop for the occasion. The optics was fitted into the tubes and mounted on 'large and original kind of altazimuth stand' supplied with vernier-circles, levels and slow-motion screw movements. Nursing Row also describes that the quality of images is good without chromatic and other aberrations (coma, etc.). '*The present telescope will discharge its duties faithfully.'* He goes on to describe his attempts of observing the eclipse[5].

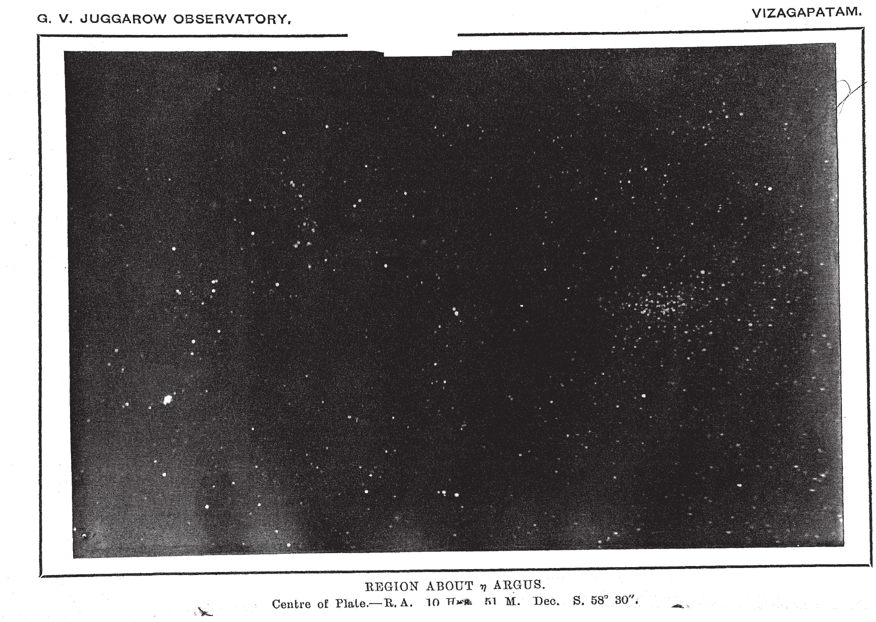



***Figure 3.** Photograph obtained at the G. V. Juggarow Observatory of ç Carina region.*

Most interesting are observations of comets by Nursing Row[6]. The spectacular sun-grazing Great Comet of 1882 II, made history as one of the comets that launched the project of 'carte du ciel' (photographic mapping of the sky). Nursing Row has presented a colourful description of post-perihelion passage of the comet: 'The length of the bright part of tail is between 7° and 8°, above the narrow rays or streaks of light extending more than 12' – concave towards the south and shaped like the *tusk of an elephant*, the thick part being at the greatest altitude'. Another comet which was observed at Daba Gardens is Comet Pons-Brooks on 31 January 1884. His enthusiasm for astronomy was such that he was always trying to improve the facilities at the observatory. Recognizing the benefits of photography to astronomical observations he 'commenced making arrangements to place the observatory on a permanent basis as well as to erect a Celestial Photographic Observatory, but he died before completing this work'.

Nursing Row regularly conducted observations of various stars, transit of Venus, transit of Mercury over Sun's disk and other astronomical phenomenon like the passage of Comet and solar and lunar eclipses. He used to send communications to Monthly Notices of Royal Astronomical Society about his observations. Nursing Row wanted to start astro-photography and spectroscopy at the observatory and made efforts to do so before his death in 1892. Nursing Row was instrumental in making a success of Jugga Row observatory. He acquired new instruments like a 6-inch aperture telescope to the observatory. He was the first Indian to get elected as a Fellow of Royal Astronomical Society in January 1871.

After Nursing Row's death his wife Srimathi Ankitam

*Figure 4. A. V. Jugga Row Bahadur grandson of the founder. He was Vice-Presidentof the Astronomical Society of India during 1911-1912 (www.avncollege.ac.in/aboutus/history.html, 2010)*

Atchuthamma garu handed over the observatory to the Madras Government and an astronomer Mr. Bion, was appointed for a period of three years. Regular observations of double stars, astro-photography of selected regions of star clusters and nebulae were started. The binary stars observed (we assume the angular separations and position angles for orbital measurements) in 1897 were 41 Aqr, μ Cygni, γ Ari, γ Cet and 326 Σ Ari. The G.V. Juggarow Observatory must have been the first one in India to systematically obtain photographic observations of the night sky. Photographs of various clusters and nebulae were taken with the small photographic telescope, the best being perhaps that of the region near η Argus (now η Carina; Figure.3).

Later the observatory's management was reverted back to Raja A.V. Jugga Row Bahadur (Figure.4), grandson of G. V. Jugga Row, and continued till 1912 in some fashion although it never attained the heights expected by Jugga Row and Nursing Row. Slowly the astronomical activity faded. The important aspect is that one inspired individual G.V. Jugga Row could evoke enough enthusiasm in people like Nursing Row and others to carry on telescopic astronomy for several decades.

**Conclusion**: The G.V. Juggarow Observatory is a unique institution that was created by an inspired individual, Juggarow, who was fascinated by the allure of the night sky and acquired the taste of making observations of celestial sources by working with an accomplished professional astronomer. He, in turn, seems to have conveyed this excitement of rediscovery of the nature and splendor of celestial sources, when the rest of the world had gone to slumber, to his son-in-law, Nursing Row, who continued to carry on this fascination of working with telescopes till his death. It was really Nursing Row who provided and developed not only the facilities at the observatory, but also conveyed his enthusiasm of whatever he has done to other astronomers and to journals, irrespective of whether it was a simple phenomenon of partial solar eclipse or looking at the red spot on Jupiter or helping measure the astronomical unit by tracking the transit of planets over the Sun's disk. Nursing Row was also aware and sensitive to the contemporary developments in astronomy. He planned to acquire a spectroscope realizing its importance in physical astronomy. He made efforts to start photographic observations of the sky, which could be materialized only after his death. The Juggarow Observatory was the only observatory in India which started systematic photographic observations of the night sky (star clusters and nebulae). Unfortunately, the work abruptly got terminated when the observatory ceased to exist.

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## राजभाषा के क्षेत्र में उपलब्धियाँ


*दिनांक 15 जून, 2011 को आयोजित हिन्दी कार्यशाला में प्रशासनिक अधिकारी के साथ उपस्थित कर्मचारीगण*

भारतीय ताराभौतिकी संस्थान के प्रोत्याहन योजना के अंतर्गत दिनांक 27 अप्रैल, 2011 को प्रशासनिक शब्दावली की प्रतियोगिता का आयोजन किया गया। इस प्रतियोगिता में 06 प्रशासनिक कर्मचारियों ने भाग लिया। विजेताओं का विवरण निम्नवत् है:

**क्र.सं. प्रतिभागी के नाम एवम् पदनाम पुरस्कार**

01.श्रीमती मालिनी राजन, वरिष्ठ कार्यालय अधीक्षक प्रथम
02.श्री वाई. यारप्पा, प्रशासनिक सहायक द्वितीय
03.श्रीमती एल. जोसफिन, वरिष्ठ अनुभाग अधिकारी तृतीय
04.श्री बी. प्राणेश राव, प्रवर श्रेणी लिपिक सांत्वना

संस्थान में सुचारु रूप से हिन्दी के कार्यान्वयन तथा कार्यसाधक ज्ञान प्राप्त प्रशासनिक कर्मचारियों को हिन्दी में कामकाज करने की क्षमता को बढ़ाने के लिए दिनांक 15 जून, 2011को हिन्दी कार्यशालाका आयोजन किया गया । भारतीय ताराभौतिकी संस्थान, बेंगलूर के अनुभाग अधिकारी (हिन्दी) श्री सिवनेसन राजनटेसन ने उक्त कार्यशाला का संचालन किया। उन्होंने उपस्थित 25 शासकीय कर्मचारियों को कम्प्यूटर पर सारांश हिन्दी साफ्टवेयर के जरिए हिन्दी टंकण से संबंधित जानकारियाँ दीं जिससे वे लाभान्वित हुए।

हिन्दी कार्यशाला में प्रशासनिक अधिकारी के साथउपस्थित कर्मचारीगण

## Farewell

### *IIA wishes all the best to ...*

... C. Sivaram joined IIA on 27June 1983 and retired as Sr. Professor on 31 May 2011 at the age of 62.

... A.V. Raveendran joined IIA on 15 March 1974 as Research Assistant and retired as Professor on 3 June 2011.

... Mr. S. Rajasekaran joined IIA, Kodaikanal on 4 March1974. He retired as Deputy Admin Officer on 3 June 2011.

... G. Nandan joined VBO, Kavalur on 1 June 1983 and retired as Mechanic 'C' on 30 June 2011.

... A. Mani joined VBO, Kavalur on 22 March1974 and retired as Sr. Mechanic Assistant 'C' on 30 June 2011.

... R. Dorairaj joined IIA , Kodaikanal on 25 March 1974 and retired as Lab. Assistant 'B' on 30 June 2011.

## Kodai Observatory Garden Bags Awards

*The flower show summer festival at Kodaikanal during May 2011 organized by the Tamil Nadu Government Horticulture Department. IIA bagged 45 prizes in total, out of which two are rolling cups for the main Garden and rose Garden, one shield for well maintained campus, besides 25 first prizes and 17 other prizes for the cut flowers.*

## Chandrasekhar Post-Doctoral Fellowship

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.

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