XXXIII[rd] Meeting of

The Astronomical Society of India

ABSTRACT BOOK- ASI 2015

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ASI-2015 Plenary Session: Life of Stars

Tuesday, 17 February 2015

Chairperson: G. C. Anupama

Time: 11:00 - 12:30 Venue: Chandrashekhar Auditorium

ASI2015_359	Devendra Ojha	11:00 am - 11:30 am	Plenary

Star formation on local scales and modes of triggered star formation

The impact of the ionization from massive OB stars plays an important role in the evolution of molecular clouds and star-forming regions at all the scales of astrophysics. The hot ionized gas compresses the surrounding cold gas, leading to the formation of a multitude of structures like bubbles, pillars, globules and filaments in which new young stellar objects can be formed through stellar feedback mechanisms. Understanding the effect of these feedback processes has been the subject of many theoretical and observational studies. In this talk, I will present recent results from our ongoing multi-wavelength study of Galactic star-forming regions and will address the following key questions: What are the formation mechanisms of different structures ? Are the formation of the young stellar objects triggered or would have they formed anyway ? Do massive stars have an impact on the mass distribution of stars (the initial mass function, IMF), etc ?

ASI2015_941	Gajendra Pandey	11.30 am-12.00 pm	Plenary

Are extreme helium and R Coronae Borealis stars, merged products of two white dwarfs?

Extreme helium and R Coronae Borealis stars are hydrogen poor but carbon rich supergiants. Two scenarios are proposed for the origin of these stars: the double degenerate (white dwarf merger), and the final helium-shell flash in a single star. In this talk, I will discuss our recent results based on Neon, Fluorine, and 13C abundances in these stars. These abundances are important clues to determining the evolutionary pathways/connections of extreme helium and R Coronae Borealis stars.

ASI2015_928	Poonam Chandra	12.00 pm-12.30 pm	Plenary

Supernovae: Shocked after the violent death of stars

Supernovae explosions are the death of massive stars. In a supernova explosion, the shocked star ejecta moves with supersonic speed and creates a high temperature and low density forward shock, and a low temperature and high density reverse shock upon interacting with the medium surrounding the star. This medium is modified owing to mass loss from the progenitor star, and the supersonic shocks moving in the slower winds created due to this mass loss acts as a time machine, thus carries tell-tale signatures of the star before its death. Thus one can study the interaction in the wind medium in detail and unravel the mysterious progenitor nature of the exploded star. In this talk I will review the diversities of the progenitors of a class of supernovae exploding in very dense medium.

ASI-2015 Parallel Sessions

Tuesday, 17 February 2015
Sun & Solar System - I: [Chairperson: Arnab Rai Choudhuri]
Time: 14:00 - 15:30 Venue: NCRA East Campus

ASI2015_484	Divya Oberoi	14:00 - 14:30	Invited

First Murchison Widefield Array Observations of a Type II Solar Radio Burst

Iver H. Cairns (2), Colin J. Lonsdale (3), J. M. Schmidt (2), J. Harding (2), J. Morgan (4), S. White (5) and The MWA Collaboration 2 - University of Sydney, Sydney, Australia 3 - MIT Haystack Observatory, MA, USA 4 - Curtin University, Perth, Australia 5 - Kirtland Air Force Base, NM, USA

The Murchison Widefield Array (MWA) is the low frequency (80-300 MHz) SKA precursor located at the site chosen for the SKA in the radio quiet Western Australian Outback and commenced formal observing in mid 2013. Solar and Heliospheric science are amongst the key science objectives of the MWA. Its spectroscopic imaging capability with much higher imaging fidelity than the earlier generation of instruments make it especially well suited for following dynamic in solar radio images simultaneously along time, frequency and polarization axes. MWA detected its first type II solar radio burst on 7 September 2014 during the period 0205 – 0215 UT. One of the SHI Group's primary targets, type II solar radio bursts are often produced upstream of shock waves driven by coronal mass ejections (CMEs) in the solar corona and solar wind. Both fundamental and harmonic emission bands were observed for this type II, both with split-band fine structures. MWA, Learmonth, and Yunnan data show the burst from 300 MHz (harmonic) to 30 MHz (fundamental). The burst did not extend below 15 MHz according to Wind spacecraft data, thereby being purely a coronal type II. A strong CME observed by the SDO and STEREO B spacecraft is plausibly associated with the type II burst. We present these data, emphasizing the unique time-varying radio source locations observed by MWA and the detailed dynamic spectra measured by MWA, Learmonth, and Yunnan. We also present initial theoretical predictions for the radio dynamic spectrum and source locations, produced by Schmidt & Cairns's combination of a detailed radio theory with 3D MHD simulations (using the University of Michigan BATS-R-US code) of the event-specific corona and CME.

ASI2015_807	Avijeet Prasad	14:30 - 14:45	Oral

Topological properties of coronal fields derived from nonlinear force-free (NLFF) magnetic field solutions

A. Mangalam Indian Institute of Astrophysics, Bangalore

Simple axisymmetric nonlinear force-free (NLFF) magnetic fields are applied to simulate photospheric vector magnetograms. Based on these simulations, we build three-dimensional axisymmetric field configurations and calculate the energy and relative helicity for active regions (ARs). We also estimate the variation of twist angle as a function of height and calculate the mean crossing number of these braided magnetic fields which provides a lower bound for the free magnetic energy. We then examine the braiding in the magnetic field and find the distribution of crossing numbers obeyed by these structures. These results provide useful information on the coronal loop structure and also imply that the coronal heating can be supplied by the braiding in the case of the active sun.

ASI2015_504	Soumitra Hazra	14:45 - 15:00	Oral

Can Flux Transport Solar Dynamo Models Function with a Shallow Meridional Flow?

Dibyendu Nandy, Center of Excellence in Space Sciences, IISER Kolkata

Kinematic dynamo models of the solar cycle that rely on magnetic flux transport processes have traditionally relied on a deep meridional flow pervading the full solar convection zone. The current understanding of the solar cycle, based not only on such dynamo models but also on flux tube dynamics simulations, is that strong toroidal flux tubes are stored and amplified in a stable layer beneath the base of the convection zone, from where they buoyantly rise to produce sunspots. However, some recent interpretations of solar meridional flow observations are along the lines that the meridional flow is shallow and remains confined to the top 10% of the Sun. Here, we explore whether flux transport dynamos could function with such a shallow meridional flow and discuss the consequences that this scenario would have on our traditional understanding of magnetic field dynamics in the solar interior.

ASI2015_821	Shyama Narendranath	15:00 - 15:15	Oral

New findings of solar coronal abundances from solar x-ray spectroscopic studies

P. Sreekumar IIA P S Athiray IIA

Good energy resolution x-ray spectrometers in space, operating at soft x-ray energies can contribute much to the study of solar coronal elemental abundance. The simultaneous measurement of the underlying continuum emission along with capacity to resolves many lines or line complexes, is a powerful tool to directly address plasma temperature, emission measure and abundances during a solar flare. Further, for bright flares, the time evolution of plasma/coronal parameters can also be studied. Going beyond the already published results from the Chandrayaan-1 XSM payload (ref: Narendranath et al 2013, Solar Physics,), we have re-examined solar flare data from the D-C1XS experiment flown onboard ESA's SMART-1 mission. We will present the initial results and conclusions.

ASI2015_720	Sowmya Krishnamurthy	15:15 - 15:30	Oral

Influence of Paschen-Back effect on atomic spectral line polarization

K. N. Nagendra^1, M. Sampoorna^1 and J. O. Stenflo^{2,3} 1: Indian Institute of Astrophysics, Koramangala, Bengaluru, India. 2: Institute of Astronomy, ETH Zurich, CH-8093 Zurich, Switzerland. 3: Istituto Ricerche Solari Locarno, Via Patocchi, 6605 Locarno-Monti, Switzerland.

Paschen-Back effect (PBE) occurs when the magnetic field produces a splitting which is of the order of or greater than the separation between the unperturbed atomic levels. The polarization content in the emergent radiation from the Sun is modified by the PBE. In this work, we apply the recently developed theory of PBE in atomic fine and hyperfine structure states including the effects of partial frequency redistribution to the case of Li {\sc i} 6708 \AA{} doublet. We explore the signatures of PBE in a single scattering of the incident radiation by the atom and their applicability for the solar magnetic field diagnostics.

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ASI-2015 Parallel Sessions

Tuesday, 17 February 2015
Stars, The Galaxy and its Neighbours - I [Chairperson: Bhaswati Mookerjea]
Time: 14:00 - 15:30 Venue: NCRA Auditorium

ASI2015_870	T Sivarani	14:00 - 14:30	Invited

Stellar Relics from the early Galaxy

One of the open problems of modern cosmology is to understand the nature of the first objects formed in the universe. Until the availability of next generation space telescopes, it is not possible to observe these first objects directly. However the first low mass stars that were formed in the Galaxy and the local dwarf satellites are still be observable in a greater detail, by the current observing facilities. These low mass stars carry the imprints of the first Supernovae. Here, we discuss some results from SDSS data and high resolution spectroscopic followup, that has shown possible nuclear processes and sites that are responsible for C,N,O and heavy element enrichment in the early galaxy. We also present possible connection between the old stellar population of the Milky way satellites, Globular clusters and the Halo stars.

ASI2015_583	Bharat Kumar Yerra	14:30 - 14:45	Oral

Role of RGB Stars in Galactic Li Evolution: Connection between Li enrichment and mass-loss

B. E. Reddy (Indian Institute of Astrophysics), C. Muthumariappan (Indian Institute of Astrophysics), Gang Zhao (NAOC, China)

A small group of red giant branch (RGB) stars were found to have anomalous high Li and far-infrared excess whose origin is not well understood. Establishing the connection between these two anomalous properties in K giants is important so as to include RGB stars as one of the Li sources for the Galactic Li enrichment. Here, we have searched for a correlation between the two anomalous properties of K giants: Li enhancement and far-IR excess from an unbiased survey of a large sample (~2000) of RGB stars. Li abundances were determined from the low resolution spectra. Further, we supplemented 15 Li-rich K giants from this sample with the 25 Li-rich K giants from other studies. Dust evolutionary models and spectral energy distributions (SEDs) were constructed using the code DUSTY to estimate different dust properties such as dust evolutionary timescales, dust temperatures, mass-loss rates etc. Results show that far-IR excess similar to Li enhancement in the K giants is very uncommon, probably, due to rapid evolution of dust and Li depletion compared to RGB evolutionary time scales. We also infer from the results that during the RGB bump evolution, giants undergo some internal changes which perhaps are the cause for mass-loss and Li enhancement events. However, the available observational results do not ascertain that these properties are correlated. A few Li-rich giants with far-IR excess seems to be pure coincidence.

ASI2015_395	Armando Arellano Ferro	14:45 - 15:00	Oral

CCD time-series photometry of Variable Stars in Globular Clusters and the metallicity dependence of Horizontal Branch structure

Sinetra Giridhar, IIA, Bangalore, India Daniel M. Bramich, Qatar Environment and Energy Research Institute, Qatar Foundation, Tornado Tower, Floor 19, P.O. Box 5825, Doha, Qatar

We present here the major findings of our ongoing program on time-series CCD photometry of globular clusters (GC) based upon the use of the Difference Image Approach (DIA) leading to extraction of very accurate light curves even in the crowded central regions down to V ~ 19 mag with uncertainties of ~0.1 mag. We have discovered nearly 200 variable stars from the extensive photometry of 12 GCs covering a metallcity range of [Fe/H]= -2.1 to -0.5 and have, thereby, updated the census of variables in each system and in some favourable cases have argued for the completenes of the RR Lyrae stars present in the cluster. The absolute magnitude and [Fe/H] for individual RR Lyrae stars has been obtained via the Fourier decomposition of the light curve, after setting the zero points of the calibrations to a homogeneous scale in a sample of 17 GC of Oosterhoff types I and II and including the two metal-rich and peculiar NGC 6388 and NGC 6441, probably of Oo III. This enables us to get an estimate of the mean distance and metallicity of the parent GC and to discuss the dependence of the horizontal branch with the metallicity via the Mv-[Fe/H] relation. We also present a calibration of the P-L relation for SX Phe stars, which enables an independent estimation of the cluster distance.

ASI2015_779	Sujan Sengupta	15:00 - 15:15	Oral

Upper Limit on Extreme-Ultraviolet Luminosity of Stars Hosting Habitable Planets.

Sujan Sengupta, Indian Institute of Astrophysics, Koramangala 2nd Block, Bangalore 560034

Habitable planets are rocky planets orbiting at such a distance from the parent stars that the surface temperature of the irradiated planet allows water to exist in liquid state. The habitability of a planet thus depends on the optical or bolometric luminosity of the star, the distance between the star and the planet and the physical properties of the planetary atmosphere. A good number of habitable planets has been discovered till date and many more are expected to be discovered in near future. However, owing to the lack of knowledge on the atmospheric properties, the ambient environment of such planets are unknown. It is known that sufficient amount of the Extreme Ultra-violet (EUV) radiation from the star can stripe out light atoms and molecules, in particular hydrogen from the upper atmosphere of a planet. If the rate of mass loss is sufficiently high then within a few billion years, substantial amount of hydrogen would escape causing the planet to become parched and hence inhabitable. Considering energy-limited hydrodynamical mass loss, an upper limit on the Extreme Ultraviolet luminosities of stars is derived which constrains the habitability of planets around them. Application of the limit to planet-hosting stars with known EUV luminosities implies that no M-type of star can have habitable planets around them.

ASI2015_850	D. Jagadheep	15:15 - 15:30	Oral

Physical conditions of MYSOs through molecular spectroscopy

Friedrich Wyrowski (MPIfR), Karl Menten (MPIfR), Silvia Leurini (MPIfR), Bikram Pradhan (IIST)

The early phases of high-mass star formation are difficult to study due to the short lifetime of this phase. This results in massive young stellar objects (MYSOs) being relatively rare and at large distances compared to the low mass counterparts. One of the ways to identify MYSOs is through observation of the maser line of methanol at 6.7 GHz since there is strong evidence of these masers being signposts of high-mass star formation. The most sensitive survey for 6.7 GHz methanol masers to date is the Arecibo Methanol Maser Galactic Plane Survey. The physical conditions of the sources identified in the survey can be studied using spectroscopy of rotational transitions of molecules such as ammonia and methanol, both molecules being tracers of gas at high densities. In this talk, I will summarize results of observations of ammonia at 23 GHz and methanol at 96 GHz and 241 GHz towards methanol masers identified in the Arecibo methanol maser survey.

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ASI-2015 Parallel Sessions

Tuesday, 17 February 2015
Extragalactic Astronomy - I [Chairperson: Prajval Shastri]
Time: 14:00 - 15:30 Venue: NCRA E-LAB

ASI2015_1051	Somak Raychaudhury	14:00 - 14:30	Invited

The early evolution of galaxies in small groups

Most galaxies form on the cosmic web. Their turbulent youth, hanging out in the filamentary network of dark matter, consists of interaction in small groups, where most of their star formation and other features of evolution takes place, long before they arrive in clusters. I will summarise our current understanding of the early life of galaxies in these small systems, and outline the first results from a multi-wavelength survey of groups involving new observations at radio (GMRT) and X-ray (Chandra and XMM-Newton) frequencies.

ASI2015_422	Atreyee Sinha	14:30 - 14:45	Oral

Blazar Monitoring from the HAGAR Cherenkov telescope

on behalf of the HAGAR collaboration. TIFR, Mumbai SINP, Kolkata IIA, Bangalore

The HAGAR array, consisting of seven telescopes at a height of 4270m in the Ladakh region of the Himalayan mountains, detects gamma rays from celestial sources using the atmospheric Cherenkov technique by wavefront sampling method. Using the time difference between the relative arrival times at each telescope, we can get the initial shower direction by using a plane wavefront fitting. The difference between the reconstructed shower direction and the telescope pointing direction gives the space angle. This space angle distribution is used to reject the cosmic ray background and get the source counts. Regular blazar monitoring of selected VHE blazars have been carried out since October 2008. Here we present the results of long term monitoring of Mkn421, Mkr501, BL~Lac and 1ES2344+514, along with multiwavelength lightcurves and spectral energy distributions.

ASI2015_682	Prasad Subramanian	14:45 - 15:00	Oral

"Blobs" in blazar jets: what are they, really?

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High energy emission from blazars is usually assumed to emanate from energetic particles confined in blobs moving along relativistic jets that are pointed at us. Explaining the origin of energetic particles in these blobs is challenging, and the problem is often compounded by observations of short timescale variability. While the concept of blobs is different for different researchers, it is broadly understood that they comprise a mixture of energetic particles and disordered magnetic fields. However, its not clear how this concept meshes with the bulk relativistic fluid flow that is generally thought to comprise the jet. It is not even clear if and how the blob can be represented as a fluid. We will explore these questions in the context of high energy emission from blazars.

ASI2015_494	Dharam Vir Lal	15:00 - 15:15	Oral

Inverse-Compton Emission from the Powerful High-Redshift Radio Galaxy, 3C270.1

R.P. Kraft (Smithsonian Astrophysical Observatory) M.J. Hardcastle (University of Hertfordshire) W.R. Forman (Smithsonian Astrophysical Observatory) C. Jones-Forman (Smithsonian Astrophysical Observatory) P.E.J. Nulsen (Smithsonian Astrophysical Observatory) J. Croston (University of Southampton)

Analysis of the radio synchrotron and X-ray inverse-Compton emission from powerful radio loud AGNs allows us to determine their particle acceleration processes and electron energy spectra. We have observed 3C270.1, bright FRII radio galaxy at z = 3.536 using Chandra. Combining these X-ray observations with archival multi-frequency radio observations, we present our preliminary results: The detection of radio jet in X-ray from the most distant radio galaxy ever seen and put constraints on the densities from the radio lobes and thermal emission, if any, from the hot phase of the ambient medium. These results would be crucial to understand the interplay between the ambient medium and the radio galaxy, and describe the properties of the particle energy spectrum in the radio lobe. We would also discuss some of these implications.

ASI2015_604	Preeti Kharb	15:15 - 15:30	Oral

Clues about Jet formation and Propagation from Multi-wavelength Observations of Intermediate Quasars

Ethan Stanley (Purdue), Matthew Lister (Purdue) and Herman Marshall (MIT)

Results from new Chandra-HST-VLA observations of three quasars with redshifts between 0.595 and 0.901 will be presented. These three quasars have Fanaroff-Riley (FR) type II-like radio powers but morphologies that are intermediate between FRIs and FRIIs. Their kiloparsec-scale jets emit copiously in the X-rays but not in the optical, consistent with the IC/CMB mechanism for the production of X-rays. In this and other properties like total radio power, these intermediate quasars resemble regular (i.e., non-intermediate) quasars. However, clearly there quasars either possess intrinsically asymmetric jets or suffer from strong jet bending on scales of tens of kiloparsec just prior to jet termination, to make them intermediate in morphology. We discuss the implications of these findings on ideas of AGN jet formation and propagation.

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ASI-2015 Parallel Sessions

Tuesday, 17 February 2015
Instrumentation - I [Chairperson: Annapurni Subramaniam]
Time: 16:30 - 18:00 Venue: Chandrasekhar Auditorium

ASI2015_667	Dipankar Bhattacharya	16:30 - 17:00	Invited

An overview of Astrosat

Indian multiwavelength astronomy satellite Astrosat is being readied for launch in 2015. The satellite will carry five scientific payloads covering the wavelength bands from optical/UV to hard X-rays, and will be especially capable of studying simultaneous multiwavelength variability of a large variety of sources with a good timing resolution, Ultraviolet imaging with 1.8 arcsec resolution and polarimetry of bright hard X-ray sources will be other key strengths of this mission. This talk will give a overview of the capabilities, present status, operation plan and primary science goals of the Astrosat mission.

ASI2015_1056	Sriram	17:00 - 17:15	Oral

Ground calibration of the UVIT

Annapurni Subramaniam (IIA), K. Sankarasubramanian (ISAC), P.U. Kamath, S. Kathiravan, Amit Kumar, P.K. Mahesh, S. Nagbhushana, S.N. Tandon (IIA), S. K. Ghosh (NCRA)

The Ultra-Violet Imaging Telescope (UVIT) onboard ASTROSAT, India's multi-wavelength astronomical satellite, is configured as twin telescopes each of ~38 cm aperture. One telescope observes in the Far-ultraviolet(FUV; 130-180 nm), and the other telescope observes in the Near-ultraviolet (NUV; 200 - 300 nm) and the Visual (VIS; 320 - 550 nm) bands. Simultaneous imaging in all the three bands is possible over a field ~ 28' diameter. The spatial resolution is < 1.8" FWHM. For optimum performance of UVIT over the range of wavelengths from FUV through the optical band, centres of the fields in the three bands need to be aligned to better than 1 arcmin. As there is no possibility of readjusting the focus in orbit, it is required that the focii are adjusted optimally. Various experiments were carried out to characterise the overall performance of UVIT such as (i) PSF determination, (ii) thermal effects on PSF, (iii) scattering of the telescope, (iv) relative alignment of the telescope, (v) determination of the sensitivity of UVIT, (vi) ground calibration of the gratings and filters and (vi) determination of the QE and distortion patter of the detector. Details of these experiments and their results will be presented.

ASI2015_671	Kallol Mukerjee	17:15 - 17:30	Oral

Ground Calibration and Creation of calibration database for Soft X-ray telescope of Astrosat mission

K. Mukerjee, Ashutosh Bajpai, Sanket Kotak, Irfan Mirza, G. C. Stewart and K. P. Singh

The Soft X-ray telescope on-board Astrosat mission has capabilities for spectroscopic, timing and imaging studies of astronomical objects simultaneously in the X-ray energy band of 0.3 to 8.0 keV. Capabilities of these measurements critically depend on extensive and accurate calibration of instrument within its acceptable operating conditions. Extensive calibration of the telescope would be carried out during the performance verification phase of the telescope after the launch of satellite. However, we have utilized currently available ground test data to establish and optimize methods and measured various performance parameters for creation of a calibration database (CALDB) for Soft X-ray telescope. The calibration database would be extensively used with pipeline processing chain and for generation of calibrated events and higher order products to fulfill scientific objectives. This paper briefly describe methods used to create CALDB products, preliminary results and their implications.

ASI2015_756	J S Yadav	17:30 - 17:40	Oral

Calibration of LAXPC instrument onboard ASTROSAT

LAXPC team

The LAXPC instrument onboard ASTROSAT consists of three large area X-ray proportional counters for X-ray timing and spectral studies in 3-80 keV energy range. The instrument consists of three co-aligned identical detectors, each with a multilayer conguration. Calibration of all the three units, was done at ISAC two meter thermovac facility during 2013-14 using three radioactive sources and specially designed calibration unit. GEANT4 simulations of the detectors were also performed and matched with actual data from calibration sources. The energy resolution is about 12% at high energies (>20 keV) and about 22% at 6 keV. The eff ective area of three unit combined is 0.8 m square in energy range 8-20 keV and drops to half of this value at 80 keV. The FWHM of the field of view is about 43 arc minute at 15 keV and about 47 arc minute at 50 keV.

ASI2015_736	Varun Bhalerao	17:40 - 17:50	Oral

The overall characteristics of the CZT-Imager

A.R. Rao et al.

The Cadmium Zinc Telluride Imager (CZTI) is one of the five scientific instruments on Astrosat. It is a coded aperture instrument, primarily aimed at simultaneous imaging and spectroscopy in the 10 - 200 keV X-ray band. CZTI has about 12% energy resolution in mid-band, a wide six-degree field of view, with an angular resolution of few arcminutes. CZTI has a unique capability of measuring X-ray polarization of bright sources. We have thoroughly tested and calibrated the 16,000 pixels of this detector, including imaging and spectroscopic capabilities. The instrument is currently at ISRO Satellite Center and is being integrated with Astrosat. In this talk, I will discuss the overall characteristics and science goals of CZTI, details of the ground calibration, and the promise of X-ray polarimetry.

ASI2015_754	Ravishankar B T	17:50 - 18:00	Oral

Calibration and ground tests of the SSM Payload

Scanning Sky Monitor on ASTROSAT operating in the X-ray band of 2 keV to 10 keV has been designed to scan the sky for (a) detecting outbursts in new transient sources, and (b) long-term monitoring of known sources. The localisation will be about several arcmin and all other experiments on ASTROSAT as well as other ground/space based observatories will be alerted about the transient events for followup observations. In order to cover a large portion of the sky, SSM is designed as an assembly of three cameras, each with a non-focussing coded mask based optics and 1d position sensitive proportional counter as detector. The whole assembly is mounted on a rotating platform, along an axis perpendicular to the boresight axis of the spacecraft. For imaging, Richarson-Lucy based deconvolution as well as SVDFIT-based methods have been used. The overlapping fields of view are combined in the sky plane to obtain better localisation and a better flux estimate of new transient sources detected. In this presentation we will discuss the ground tests carried out for position calibration, energy calibration to characterise the instrument parameters, tests to assess the imaging capabilities of the SSM cameras, describe the analytical exercise undertaken for sky background estimation and describe the data processing involved.

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ASI-2015 Parallel Sessions

Tuesday, 17 February 2015
GR & Cosmology - I [Chairperson: K. Subramanian]
Time: 16:30 - 18:00 Venue: NCRA Auditorium

ASI2015_491	Hamsa Padmanabhan	17:00 - 17:15	Oral

Probing the universe : through reionization and later

R. Srianand, IUCAA, Pune T. Roy Choudhury, NCRA, Pune Alexandre Refregier, ETH, Zurich

Recent observations of the ionized near-zones of quasars around redshift 6 have indicated an additional source of heating of the intergalactic medium, which has been claimed to be evidence for the beginning stages of helium reionization occurring at this redshift. I will describe how this effect may be studied with hydrodynamical simulations coupled to a radiative transfer code which we have developed. We find that the heating effect depends on the general equation of state of the IGM at that epoch, with steeper equations of state exhibiting less additional heating. This connects the heating due to helium reionization in the quasar near-zones, with the epoch of hydrogen reionization. The additional heating is also dependent on the initial neutral fraction of helium in the quasar vicinity, which points to constraints on single-step reionization scenarios. The heating effect may be effectively captured beyond the cosmic variance by using the curvature statistics, even if the sample size is half what is presently available. In the post-reionization universe, the 21-cm line of neutral hydrogen (HI) promises a powerful probe of the baryonic and dark matter distribution. I will describe how the combination of current observational and theoretical constraints on the neutral hydrogen density and the bias parameter leads to bounds on the power spectrum of HI intensity fluctuations over redshifts 0 to 4. References: 1. Hamsa Padmanabhan, T. Roy Choudhury, R. Srianand (2014), MNRAS 443, 3761 2. Hamsa Padmanabhan, T. Roy Choudhury, Alexandre Refregier (2014), arXiv:1407.6366

ASI2015_616	Raghunath Ghara	17:15 - 17:30	Oral

21 cm signal from cosmic dawn

Tirthankar Roy Choudhury and Kanan K. Datta

Observations of redshifted 21 cm radiation from the epoch of reionization promises to provide information on the physical processes during that epoch. Many low frequency interferometers are trying to provide statistical measurements of this signal, such as its power spectrum. Beside observations numerical simulations are essential to derive tight constraints on different aspects of reionization like the nature of first sources, relative level of emission from UV and X-ray sources etc. We present a formalism for generating the δT_b distribution using dark matter simulations and an one-dimensional radiative transfer code. Our analysis is able to account for the spin temperature $T_{\rm S}$ fluctuations arising from inhomogeneous X-ray heating and $Ly{\alpha}$ coupling during cosmic dawn. The δT_b power spectrum amplitude at large scales ($k \sim 0.1$ Mpc^{-1}) is maximum when $\sim 10\%$ of the gas (by volume) is heated above the CMB temperature. The power spectrum shows a “bump”-like feature during cosmic dawn and its location measures the typical sizes of heated regions. Also, one need to consider the effect of peculiar velocities of gas (redshift space distortion) while generating δT_b distribution. We find that the effect of peculiar velocities on the power spectrum is negligible at large scales for most part of the reionization history. During early stages (when the volume averaged ionization fraction $\lesssim 0.2$) this is because the signal is dominated by fluctuations in $T_{\rm S}$. For reionization models that are solely driven by stars within high mass ($\gtrsim 10^9 M_{\odot}$) haloes, the peculiar velocity effects are prominent only at smaller scales ($k \gtrsim 0.4$ Mpc^{-1}) where patchiness in the neutral hydrogen density dominates the signal. The conclusions are unaffected by changes in the amplitude or steepness in the X-ray spectra of the sources. We also study the effect of the evolution of the signal along the line-of-sight.

ASI2015_623	Mayuri Sathyanarayana Rao	17:30 - 17:45	Oral

On the detection of spectral ripples from the Epoch of Recombination

Ravi Subrahmanyan (Raman Research Institute), N Udayashankar (Raman Research Institute), Jens Chluba (The Johns Hopkins University)

Photons emitted during epoch of Hydrogen (500 < z < 2000) and Helium recombination (1600 < z <3500 for HeII → HeI and 5000 < z < 8000 for HeIII → HeII) are predicted to appear as additive spectral distortions in the Cosmic Microwave Background. Detecting the cosmological hydrogen recombination lines would provide a better understanding of the thermal and ionisation history of the Universe and would provide an additional way to determine some of the key parameters of the Universe among others. In this talk we will present a feasibility study to experimentally detect these recombination lines of cosmological origin, the choice of frequency range, integration time for a ground based detection experiment and an algorithm for foreground subtraction. We will also talk about APSERa - Array of Precision Spectrometers for the Epoch of RecombinAtion, a venture to detect these recombination lines.

ASI2015_654	Sourabh Paul	17:45 - 18:00	Oral

Study of the 21 cm Epoch of reionization and foregrounds with Murchison Widefield Array.

Shiv K. Sethi, N. Udaya Shankar, K. S. Dwarakanath, Ravi Subrahmanyan, MWA Collaboration.

The Detection of 21 cm emission from neutral hydrogen of EoR is a challenging task due to the weakness of the signal. This is also limited by the various foreground effects. Thus any EoR experiment involves data of long duration and statistical analysis of the data might separate the signal from various foregrounds. In this paper we present analysis results of 3, 8 and 11 hours data of EoR1 field from Murchison Widefield Array (MWA). These include the power spectra measurement of both XX and YY polarizations. One of the goals here to locate the cleaner regions to study EoR and also study the interplay between noise and foregrounds. We discuss the comparison between isolation and removal of the foreground from the data and try to infer which method leads to less contamination in the EoR window. We also present some simulation results of an alternative drift scan technique. Few hours of drift scan data from MWA is analyzed and compared with the simulation.

Jayant Narlikar	18:30 - 19:30	Evening Lecture

Cosmology, Fred Hoyle and I

This talk will try to highlight the seminal contributions to astronomy and astrophysics by Fred Hoyle. These will include nucleosynthesis, interstellar dust, the steady state and the quasi steady state cosmologies, stellar evolution, molecular astronomy, etc. The description will be from my personal viewpoint and will try to show that many of Hoyle's ideas were well ahead of their time and may yet prove to be right.

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ASI-2015 Plenary Session: The Local Universe

Wednesday, 18 February 2015

Chairperson: K. S. Dwarakanath

Time: 09:00 - 10:30 Venue: Chandrashekhar Auditorium

ASI2015_994	Chanda J. Jog	9.00 am-9.30 am	Plenary

Gravitational instabilities affected by external tidal field

The well-known Jeans criterion describes the onset of instabilities in an infinite, homogeneous, self-gravitating medium supported by pressure. Most realistic astrophysical systems, however, are not isolated. A modified instability criterion for a system in an external tidal field has been obtained. A typical, disruptive field is shown to make the system more stable against perturbations resulting in a higher effective Jeans mass. Conversely, a compressive tidal field, as seen in centres of galaxies, makes it easier to form instabilities. Similarly, the Toomre Q criterion for a rotating disk gets modified, and the external dark matter halo is shown to stabilize a galactic disk. This can help explain why star formation is suppressed in Low-Surface-Brightness galaxies which are dominated by dark matter halo at all radii.

ASI2015_967	Jayaram N Chengalur	9.30 am-10.00 am	Plenary

Cold Gas and Star formation in Nearby dwarfs

We will present results from a study of the gas and star formation in nearby, extremely faint dwarf irregular galaxies. The galaxies that we study are drawn from the Faint Irregular Galaxy GMRT Survey (FIGGS). For all of the FIGGS galaxies, high spectral and velocity resolution HI data is available from GMRT observations. In addition, for most of the sample galaxies, multi-wavelength data, including GALEX UV images, as well as ground based H-alpha and broad band CCD images are available. We use HI data to study the phase structure of the ISM in these galaxies, in particular to try and identify atomic gas that is in the dense Cold Neutral Medium phase. For the sample galaxies the star formation rate can be estimated from the H-alpha or FUV images. We examine the relation between the star formation rate, and the atomic gas, both the total atomic gas, as well as the gas in the dense cold phase.

ASI2015_1031	Subhashis Roy	10.00 am-10.30 am	Plenary

Equipartition magnetic fields in nearby spiral galaxies

Magnetic fields play an important role in dynamics and energetics of interstellar medium and in star formation in galaxies. Assuming energy equipartition between magnetic fields and cosmic ray particles, we have determined magnetic fields in six nearby face-on spiral galaxies at sub-kpc spatial resolution. The mean magnetic field is found to be about 11 micro-Gauss. The field is strongest near the central regions with mean values of ~20 micro-Gauss and fall to 15 micro-Gauss in disc to 10 micro-Gauss in outer parts. The field strength in interarm regions are about 20% weaker than in arms. No significant variation of magnetic fields along arms are noted after correcting for the radial variation of magnetic fields. The energy density in the interstellar medium (turbulence) is found to be comparable to energy density in the magnetic fields within a factor of 2 at sub-kpc scales in the arms. Magnetic energy density is seen to dominate over the kinetic energy density of gas in the interarm regions and outer parts of the galaxies.

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ASI-2015 Parallel Sessions

Wednesday, 18 February 2015
Sun & Solar System - II [Chairperson: P K Manoharan]
Time: 11:30 - 13:00 Venue: NCRA Auditorium

ASI2015_1033	R. Ramesh	11:30 - 12:00	Invited

Observations of the solar corona at low radio frequencies

The Indian Institute of Astrophysics (IIA) is operating a low frequency (~120 - 30 MHz) radioheliograph at the Gauribidanur observatory, about 100 km north of Bangalore, for dedicated two-dimensional imaging observations of the solar corona since 1997. Presently the array (Gauribidanur RAdioheliograPH - GRAPH) is being upgraded in a phased manner to improve the spatial, temporal, spectral resolutions and sensitivity. In addition to the heliograph, IIA is also operating a radio spectrograph (Gauribidanur LOw frequency Solar Spectrograph, GLOSS) and a radio polarimeter (Gauribidanur Radio Interference Polarimeter, GRIP) - both in the same frequency range and dedicated for solar observations similar to the GRAPH (see http://www.iiap.res.in/centers/radio for details). Radio emission in the above frequency band corresponds typically to the heliocentric distance range of ~ 1.2 - 2.0 solar radii where observations in other regions of the spectrum are presently limited. Additionally, radio observation has the unique advantage of simultaneously observing the corona overlying the solar disk as well as off the solar limb. An overview of the scientific results (particularly related to the coronal mass ejections, coronal magnetic field, and the weak energy releases) that have been obtained so far with the above instruments and the scope of combining observations from Gauribidanur and those with the coronagraph and X-ray spectrometers on board ADITYA-1, our country's proposed first space solar mission, will be discussed.

ASI2015_806	Jishnu Bhattacharya	12:00 - 12:15	Oral

Frequency shifts of resonant modes of the Sun due to near-surface convective scattering

Shravan Hanasoge, TIFR H.M. Antia, TIFR

Abstract Measurements of oscillation frequencies of the Sun and stars can provide important independent constraints on their internal structure and dynamics. Seismic models of these oscillations are used to connect structure and rotation of the star to its resonant frequencies, which are then compared with observations, the goal being that of minimizing the difference between the two. Even in the case of the Sun, for which structure models are highly tuned, observed frequencies show systematic deviations from modelled frequencies, a phenomenon referred to as the ``surface term". The dominant source of this systematic effect is thought to be vigorous near-surface convection, which is not well accounted for in both stellar modelling and mode-oscillation physics. Here we bring to bear the method of homogenization, applicable in the asymptotic limit of large wavelengths (in comparison to the correlation scale of convection), to characterize the effect of small-scale surface convection on resonant-mode frequencies in the Sun. We show that the full oscillation equations, in the presence of temporally stationary 3-D flows, can be reduced to an effective ``quiet-Sun" wave equation with altered sound speed, Br\"{u}nt--V\"{a}is\"{a}la frequency and Lamb frequency. We derive the modified equation and relations for the appropriate averaging of three dimensional flows and thermal quantities to obtain the properties of this effective medium. Using flows obtained from three dimensional numerical simulations of near-surface convection, we quantify their effect on solar oscillation frequencies, and find that they are shifted systematically and substantially. We argue therefore that consistent interpretations of resonant frequencies must include modifications to the wave equation that effectively capture the impact of vigorous hydrodynamic convection.

ASI2015_570	Nithin Mohan	12:15 - 12:30	Oral

Radio Observation of Venus at Meter Wavelengths using the GMRT

Subhashis Roy(2), Govind Swarup(2), Divya Oberoi(2), Niruj Mohan Ramanujam(2), C. Suresh Raju(1), and Anil Bhardwaj(1) 1-Space Physics Laboratory, VSSC, Trivandrum, 695022, Kerala, India; 2-National Center for Radio Astrophysics, TIFR, Pune, 411007, Maharashtra, India.

The dense atmosphere of Venus limits the use of visible light for probing the surface of Venus. The temperature of the surface of Venus has been measured by Venera landers as about 740 K, with little variation during the day and night, due to the greenhouse effect by its dense Carbon Dioxide dominated atmosphere. The surface of Venus has been explored by measuring radar reflections and thermal radio emission at microwave frequencies (cm/decimeter wavelengths) by several observers using the Earth-based and the space borne observations. Models based on these observations have not been able to explain values of the brightness distribution of Venus at metre wavelengths. We describe observations of Venus made at 610, 325 and 244 MHz using the Giant Metrewave Radio Telescope (GMRT). Observations were made during March 21-27, 2004 when the Venus had a diameter of ~ 21.5 arcsec. The resulting beamwidth of the GMRT was ~ 6, ~ 12 and ~ 24 arcsec at 610, 325 and 244 MHz, respectively. The derived brightness temperature (Tb) of Venus was 485 K, 430 K and < 330 K with errors of < 10 %, respectively, for the above frequencies. These values are consistent with values of about 550 K measured at 608 MHz and 430 MHz during 1970s by previous workers (see Condon et al. 1973) and are much lower than those measured at higher frequencies, e.g. 679.9 K +/- 13.6 at 4.86 GHz by Butler et al. 2001 using the VLA. The microwave observations (cm wavelengths) of Tb of Venus have been explained in the literature by considering emission from its atmosphere, surface and sub-surface. For explaining lower values of Tb at frequencies < 1 GHz (metre wavelengths), we propose a new model in which heat flows from the hot surface of Venus towards the interior and radiation arises at longer wavelengths further down from the surface of Venus at lower physical temperature. It is planned to develop a detailed radiation transfer model.

ASI2015_533	Hajime Kita	12:30 - 12:45	Oral

Study on short-term variation mechanism of the Jovian radiation belt based on radio interferometer observations

Hiroaki Misawa (1), Anil Bhardwaj (2), Fuminori Tsuchiya (1), Chihiro Tao (3), Yoshizumi Miyoshi (4), Go Murakami (5), Takeshi Sakanoi (1), Yasumasa Kasaba (1), Akira Morioka (1), (1) Tohoku Univ., Japan, (2) Space Physics Laboratory, Vikram Sarabhai Space Centre, India, (3) IRAP, France, (4) Nagoya Univ., Japan, (5) ISAS/JAXA, Japan

Jovian synchrotron radiation (JSR) is the emission from relativistic electrons in the strong magnetic field of the inner magnetosphere, and it is the most effective probe for remote sensing of Jovian radiation belt from the Earth. Although JSR has been thought to be stable for a long time, recent intensive observations of JSR have revealed its short term variations with the time scale of days to weeks. Brice and McDonough [1973] proposed a scenario for the short term variations (hereafter the B-M scenario); i.e, the solar UV/EUV heating of Jovian upper atmosphere drives neutral wind perturbations and the increase in induced dynamo electric field leads to enhancement of radial diffusion. Previous studies confirmed that the short term variations in total flux density correspond to the solar UV/EUV variations. In addition, recent radio interferometer observations found short term variations in brightness distribution. However, confirmation of this scenario succeeded partially, and investigation of short term variations in brightness distribution and the possible causes needs to be investigated further. The purpose of this study is to confirm the B-M scenario based on observations of JSR and Jovian upper atmosphere. We made simultaneous observations of Giant Metrewave Radio Telescope (GMRT) and NASAs InfraRed Telescope Facility (IRTF) in 2011. From GMRT observations, the total flux density increased from 6th Nov. to 13th Nov in 2011, by about 5%, corresponding to the solar UV/EUV variations. From IRTF observations, intensity of H3+ also increased and estimated temperature variation was ~10K. On the other hand, peak position of JSR shifted outwards, which is inconsistent with enhancement of radial diffusion and implies unidentified strong local loss process. We examined this scenario by a radial diffusion model and found that enhancement of radial diffusion and Coulomb scattering could explain outward shift of JSR peak position. The GMRT observation also indicated short term variations in dawn-dusk brightness asymmetry of JSR. As a possible candidate, an effect of the dawn-dusk electric field in the Jovian magnetosphere was examined. We made simultaneous observation of the GMRT and SPRINT-A in 2014, where SPRINT-A is Japanese space telescope satellite launched in 2013 mainly dedicated for planetary science. We used dawn-dusk EUV emission ratio of Io plasma torus as an index of dawn-dusk electric field. We found that variations of dawn-dusk ratio of JSR correspond to the dusk-dawn ratio of Io plasma torus. The variations of dawn-dusk ratio of JSR are ~0.04, which corresponded to the electric field variations of 4 mV/m. Hence, dawn-dusk electric field is expected to affect the radiation belt electrons.

ASI2015_871	Rajbir Kaur	12:45 - 13:00	Oral

Whistler-mode Instability in Presence of Parallel Electric Field in Magnetosphere of Uranus

R.S. Pandey Amity Institute of Applied Sciences, Amity University, Sector-125, Noida, U.P, India

In present work, obliquely aligned whistler mode waves are analyzed, in the presence of DC parallel electric field in background plasma having relativistic Maxwellian distribution function in the magnetosphere of Uranus. The effect of various plasma parameters are investigated by deriving the dispersion relation for whistler waves propagating oblique to magnetic field direction. Following the kinetic approach, it is found that temperature anisotropy, magnitude of electric field, energy density and number density of particles supports the growth rate and relativistic factor does not. The present work is basically based upon the theoretical investigation and mathematical analysis of the magnetosphere of Uranus, supported by satellite data. Results are also discussed in context to magnetosphere of Earth and also gives theoretical explanation to existence of whistler mode waves in presence of DC parallel field observed by Voyager 2 in the magnetosphere of Uranus.

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ASI-2015 Parallel Sessions

Wednesday, 18 February 2015
Extragalactic - II [Chairperson: Mousumi Das]
Time: 11:30 - 13:00 Venue: NCRA E-LAB

ASI2015_1052	Joydeep Bagchi	11:30 - 12:00	Invited

Spiral galaxy radio jets: The secret sits in the middle and knows

All galaxies may contain a central massive black hole, but presently the majority are quiet and inactive. A fraction of these black holes however accrete so much matter that they outshine the combined light from all their stars. These active galaxies occasionally also launch radio jets, which shoot out from the active nucleus upto Mpc distances, earning themselves the title of 'radio galaxies'. However, powerful radio jets on >100 kpc scales are nearly always launched from the nuclei of elliptical galaxies and not spirals, and the typical radio luminosity of spiral galaxies is about 10^3-10^4 times feebler than ellipticals, making them comparatively radio-quiet. The physical origin of this dichotomy and the mechanism by which relativistic jets are launched from accretion disks have long been the subject of intense investigations, yet the issue still remains unresolved despite a wealth of observations. Recently observations of a few rare spiral galaxies with >100 kpc jets have generated an intense renewed interest in this field. I discuss our recent discovery of an extraordinary spiral galaxy J2345-0449, ejecting record 1.6 Mpc scale jets, that challenges the conventional wisdom and provides a rare opportunity for probing the physics of dichotomous dependence of relativistic jet formation on the galaxy morphology and its central black hole properties - like its mass and spin. We show that these huge radio jets are probably triggered via the so-called "Blandford-Znajek" mechanism, resulting from a high mass and fast spin acquired by the central black hole. The estimated mass of this black hole is unusually high for a spiral galaxy which is extremely massive too. Our ground breaking results point towards an unusual formation route which has assembled coevally, both the massive, spinning black hole and the fast-rotating galactic disk over a cosmological time scale. Our findings provide new insights into the formation process of super massive black holes and the origin of relativistic jets in the galactic nuclei, and this remarkable galactic system also serves as a uniquely powerful laboratory for many future studies.

ASI2015_510	Ruta Kale	12:00 - 12:15	Oral

Probing cluster and super-cluster scale radio emission with the Murchison Widefield Array

S. Bardelli, G. Brunetti, R. Cassano, D. Dallacasa, K. S. Dwarakanath, S. Giacintucci, M. Johnston-Hollitt, M. Rossetti, T. Venturi

The Murchison Widefield Array (MWA) is a SKA precursor operational between 80 - 300 MHz located in western Australia. It consists of an array of 2048 dipole antennas placed over a region of 1.5 km. This compact configuration allows us to probe radio emission on the scales of galaxy clusters ($\sim$ Mpc) and super-clusters (10s of Mpc). We have started a study of the Shapley Super-Cluster (SSC) combining the capabilities of the MWA with that of the GMRT at 150 MHz. The SSC is the nearest (redshift ~ 0.048) largest concentration of galaxies formed by about 25 galaxy clusters and several galaxy groups. We have observed it with the MWA at 100, 150 and 200 MHz in the tracking mode for 3 hours. The field is dominated by the radio galaxy Centaurus A-- creating an imaging challenge. We will present the images of the SSC with the MWA. The aspects of imaging and the nature of the detected radio sources in the SSC will be discussed.

ASI2015_804	T MAGESHWARAN	12:15 - 12:30	Oral

Stellar dynamics around BHs and it observational implications for quiescent galaxies

ARUN MANGALAM and INDIAN INSTITUTE OF ASTROPHYSICS, BANGALORE

Stars close to the galactic center moves in the potential field of both Supermassive Black Hole (SMBH) and other stars in the galaxy. The SMBH influences the orbital and spatial distribution of stars in the inner region of its host galaxy which together determine the ingestion rate of stars. It has been also well established by observations that SMBH of 10^6-10^8 $M_{\odot}$ capture stellar debris from tidally disrupted stars that result in X-Ray, UV and Optical flashes. A star whose orbit's pericenter lies within the radius $\displaystyle{R_{t}\sim R_{\star} (M_{\bullet}/ M_{\star})^{1/3}}$ is tidally disrupted by SMBH. The pericenter radius of star's orbit depends on both energy and angular momentum of the orbit. Broadly, the mass infall rate after disruption follow $t^{-5/3}$ law, the details of which depend on the nature of accretion between tidal radius and horizon of SMBH and also on the structure and properties of the star. We simulated the light curve profiles in different spectral bands with a gas dynamical model to make theoretical predictions for the rate of detections of such events by various missions performing in either all sky survey (ASS) mode or deep imaging survey (DIS) mode.

ASI2015_502	Kaustubh Vaghmare	12:30 - 12:45	Oral

Where do S0 Galaxies Fit in the Overall Picture of Galaxy Formation and Evolution?

Sudhanshu Barway (South African Astronomical Observatory) Yogesh Wadadekar (National Centre for Radio Astrophysics) Ajit Kembhavi (IUCAA)

Originally, S0 aka lenticular galaxies have been given a conspicuous position on the Hubble tuning fork of galaxies. This position implies that S0 galaxies are a transition class of objects between spirals and elliptical galaxies. However recent research shows that S0 galaxies comprise sub classes with dramatically different formation histories and physical properties. In the current talk I will summarize the work done by me in this field which aims at developing a better understanding of how S0 galaxies fit into the overall picture of galaxy formation and evolution. This work includes a multiwavelength study using data from major observatories including GALEX, SDSS, 2MASS and WISE which demonstrates the dependence of star formation history on luminosity and environment; and also a study carried out in mid-IR using Spitzer data where structural parameters were determined for a sample of S0 and spiral galaxies and their relation to each other has been explored. The talk, while emphasizing the results of the above work, will also aim at summarizing the general understanding of S0 galaxies and why it is important to understand their formation.

ASI2015_567	HONEY M	12:45 - 13:00	Oral

Secular evolution in barred Low Surface Brightness Galaxies

Mousumi Das IIA, BANGALORE

We present the early results of our study on the secular evolution of barred Giant Low Surface Brightness(GLSB) galaxies. GLSB galaxies are very good candidates for the study of secular evolution in dark matter dominated systems because they are rich in dark matter and evolve in relatively isolated environments. The secular evolution of disk galaxies predicts that as the bars evolve their morphology will change, often resulting in the formation of oval pseudobulges or rounder bars. To see how this applies to dark matter dominated galaxies we examine the correlation of bar ellipticites in the barred GLSB galaxies with their dynamical masses. We have used the SDSS archival data for this study. We used GALFIT to estimate the deprojected bar ellipticities from the I band images. The penalized Pixel Fitting (pPXF) code was used to determine the velocity dispersion and hence the dynamical masses in the centers of these galaxies from their optical spectra. We discuss the results and compare this with the predictions from the theory of secular evolution of disk galaxies.

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ASI-2015 Parallel Sessions

Wednesday, 18 February 2015
Instrumentation & Techniques - II [Chairperson: A Ramprakash]
Time: 11:30 - 13:00 Venue: NCRA East Campus

ASI2015_668	Koshy George	11:30 - 12:00	Invited

WFOS - TMT first light instrument

The Wide field optical spectrograph, MOBIE is a seeing-limited, wide-field imaging multi-object echellette spectrograph for TMT. I will give a brief description of the instrument design and operation concepts along with a mention of the ongoing efforts happening within the country towards development of this first light instrument on TMT.

ASI2015_812	Saurabh	12:00 - 12:15	Oral

TIFR-ARIES Near Infrared Spectrometer (TANSPEC)

D K Ojha (TIFR) A K Pandey (ARIES) S K Ghosh (TIFR) TANSPCE TEAM (ARIES+TIFR)

Through this project, TIFR-DAA and ARIES will bring together their resource pools for the development of a 0.8 to 2.5 micron Medium Resolution Spectrograph to be used on the main Cassegrain port of 3.6 metre Devasthal Optical Telescope. The instrument called TANSPEC, will provide unique medium resolution (R ~ 2000) spectroscopy capability to the telescope in a broad waveband range of 0.8 to 2.5 microns. It will also have low resolution prism mode (R~200) and a slit viewer with field of view of 1 x 1 arcmin square. This instrument will be extremely sensitive to low temperature stellar photospheres (T · 2500 K) and objects surrounded by warm dust envelopes or embedded in dust/molecular clouds. It is therefore particularly suited to the study of low and very low mass stellar populations (M/Ldwarfs, brown dwarfs), strong mass-losing stars on the asymptotic giant branch (AGB), young stellar objects (YSOs) still in their proto-stellar envelopes and active galactic nuclei (AGN). In this talk, I will discuss about the specification and science goal of this instrument along with some recent updates.

ASI2015_589	Yashwant Gupta	12:15 - 12:30	Oral

The GMRT : Current Status and Future Prospects

Yashwant Gupta, NCRA-TIFR

The Giant Metrewave Radio Telescope (GMRT) is today a major international Radio Astronomy facility working in five discrete bands in the frequency range of 150 MHz to 1500 MHz, with a maximum instantaneous bandwidth of 32 MHz. Consisting of 30 fully steerable antennas of 45 metre diameter each, it can be used as an aperture-synthesis array for imaging, as well as a phased array to study compact radio sources such as pulsars. The GMRT has produced several important results in the past few years. Some recent interesting results will be highlighted. The GMRT is undergoing a major upgrade that will improve its sensitivity by a factor of upto three and make it a much more versatile instrument. The goal is to have seamless frequency coverage from about 100 to 1500 MHz, with a maximum instantaneous bandwidth of 400 MHz; improved receiver systems with higher G/Tsys; versatile digital back-end correlator and pulsar receiver using the latest FPGA and GPU technologies; revamped servo system; sophisticated monitor and control system; and matching improvements in infrastructure and computing. Several of these activities are past the prototyping phase and the sub systems are in mass production and delivery phase; an 8 antenna phase I of the u-GMRT has been released to internal users for trials. Overview of the upgrade activities, their current status and future plans will be covered.

ASI2015_686	Niruj Mohan Ramanujam	12:30 - 12:45	Oral

A Fully Real-time Pipeline at the GMRT for Detection of Fast Transients

Sanjay Kudale (NCRA-TIFR), Yashwant Gupta (NCRA-TIFR), Rohini Joshi (Drexel University), Jayanta Roy (Jodrell Bank)

A new area in radio astronomy that is opening up is that of fast radio transients. Over the last few years, many examples have been seen of transient sources lasting typically msecs, occurring only once, whose origin is yet unknown. Many radio observatories around the world are gearing up to detect such transients in real-time. Sensitive multi-element instruments like the GMRT can play a significant role in this exploration for fast transients. We present the details of our efforts to build a real-time transient detection system for the GMRT, following-up on an existing off-line pipeline. It is being designed to run in piggy-back mode with any ongoing observation. It exploits the multi-element capability of the GMRT to generate four incoherent array beams from four sub-arrays. Using high performance Graphical Processing Units (GPUs) as compute engines, data from each beam are dedispersed for a range of DMs and short-duration single pulse events are searched for. Finally, these detected events are passed through a coincidence filter to discard spurious candidates. We describe details about the implementation of this real-time pipeline and also present results from initial tests. Issues relating to real-time performance over a range of frequencies, performance on GPUs, fine tuning of the detection algorithms, pipeline optimisation are discussed in detail. Plans for future work are also described.

ASI2015_489	K. Sasikumar Raja	12:45 - 13:00	Oral

Design and performance study of a meter wavelength narrow band cross-polarized log-periodic dipole antenna to observe the polarized radio emission

K. Sasikumar Raja1, C. Kathiravan1, R. Ramesh1, M. Rajalingam1, and Indrajit V. Barve1 1Indian Institute of Astrophysics, II Block, Koramangala, Bangalore-560 034.

We designed and fabricated a cross-polarized log-periodic dipole (CLPD) antenna at Gauribidanur Radio Observatory, India to observe the circularly polarized radio emissions from the solar corona at meter-wavelengths. The CLPD consists of a two log-periodic dipole (LPD) antennas which are arranged in orthogonal fashion with a common axis. Since the commercially available CLPD has the isolation is approximately -20 dBm, We planned to design antenna which has the isolation as low as possible. The performance study of designed CLPD was carried out and measured isolation between the two mutually orthogonal LPD antennas was as low as ≈ – 43 dBm in the 65-95 MHz range. By making use of such CLPD antennas, two element interferometric polarimeter was build and successfully recorded polarized emissions in both Stokes I and V at 80 MHz. Note that such observations gives the information about the magnetic field strengths of the solar corona. Since the structure of the antenna is compact and rigid it can be used as a feed of dish antennas. This antenna also can be used to transmit/receive circularly polarized radio waves through the Earth's ionosphere, which in general washout the linear polarization at low frequencies. We intend to build broad band CLPD antenna so that different layers of the solar corona can be observed by building a interferometric polarimeter array.

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ASI-2015 Parallel Sessions

Wednesday, 18 February 2015
Stars, The Galaxy and its Neighbours - II [Chairperson: Anandmayee Tej]
Time: 14:30 - 16:00 Venue: NCRA E-LAB

ASI2015_939	Santosh Joshi	14:30 - 15:00	Invited

Asteroseismic Investigation of the Chemically Peculiar Stars

Here, I present the ground based photometric and spectroscopic analysis of a set of chemically peculiar pulsating variables discovered from ARIES Nainital. For the asteroseismic study of these stars, the time-series photometric, high-resolution spectroscopic and spectro-polarimetric data were obtained from six telescopes located at different parts of the globe. Apart from the ground based observations, I also present results on the time-resolved photometric analysis of the few interesting pulsating stars observed by Kepler space mission. These observations are used to derive the various astrophysical parameters that help us to know their evolutionary status. Finally, I will present the preliminary instrumental design of a time-series CCD photometer for the side port of the 3.6 m telescope at Devasthal (ARIES) to study the asteroseismic investigation of the pulsating variables and the transient sources.

ASI2015_569	Anupam Bhardwaj	15:00 - 15:15	Oral

On the Variation of Fourier Parameters for Galactic and LMC Cepheids at Optical, Near-Infrared and Mid-Infrared Wavelengths

Anupam Bhardwaj, Harinder P. Singh, Shashi M. Kanbur, Lucas M. Macri, Chow-Choong Ngeow

We present a light curve analysis of fundamental-mode Galactic and Large Magellanic Cloud (LMC) Cepheids based on the Fourier decomposition technique. We have compiled light curve data for Galactic and LMC Cepheids in optical (VI), near-infrared (JHKs) and mid-infrared (3.6 - & 4.5 -μm) bands from the literature and determined the variation of their Fourier parameters as a function of period and wavelength. We observed a decrease in Fourier amplitude parameters and an increase in Fourier phase parameters with increasing wavelengths at a given period. We applied a binning method to analyze the progression of the mean Fourier parameters with period and wavelength. We found that for periods longer than about 20 days, the values of the Fourier amplitude parameters increase sharply for shorter wavelengths as compared to wavelengths longer than the J-band. We observed the variation of the Hertzsprung progression with wavelength The central period of the Hertzsprung progression was found to increase with wavelength in the case of the Fourier amplitude parameters and decrease with increasing wavelength in the case of phase parameters. We also found a small variation in the central period of the progression between the Galaxy and LMC, presumably related to metallicity effects. These results will provide useful constraints for stellar pulsation codes that incorporate stellar atmosphere models to produce Cepheid light curves in various bands.

ASI2015_568	Supriyo Ghosh	15:15 - 15:30	Oral

Phase dependent spectro-photometric studies of a new Mira variable MASTER Optical Transient J212444.87+321738.3

Supriyo Ghosh^1, Soumen Mondal^1, Ramkrishna Das^1, N. M. Ashok^2, D. P. K. Banerjee^2, \& Somnath Dutta^1 \\ ^{1}S. N. Bose National Centre for Basic Sciences, Salt Lake, Kolkata-700 098 \\ ^{2}Physical Research Laboratory, Navrangpura, Ahmedabad-380 009 \\

We present here optical/near-IR photometric and spectroscopic observations of the MASTER bright optical transient J212444.87+321738.3 using the Near-IR Imager cum spectrograph(NICMOS-3) on the 1.2-m IR telescope at Mt. Abu, and HFOSC and TIRSPEC on 2m Himalayan Chandra Telescope (HCT) at Hanle. The optical/near-IR spectra shows molecular features of TiO,VO, CO overtone and water bands, which is a signature of cool M-type stars. The NIR spectra indicates the likely O-rich nature as the C_2 bandhead at 1.77 μm is absent and it shows the likely presence of Si I absorption at 1.59 μm. The large (J-K) colour index of about 2.0 mag suggests that the source might be a late M-type star. The source was monitored in optical I-band using 40 cm telescope at Chile through International collaboration over 550 days, and shows the period of about 512 days with variability amplitude of about 4 mag in I-band. The luminosity class is confirmed from spectral data fitting using Phoenix theoretical models, which match well only with surface gravities of giants. These observations confirm that the source is a O-rich Mira variable. We also study the phase-dependent optical/Near-IR spectral variability of the source, which shows significant variable molecular features (e.g. VO, TiO, H$_2$O and CO bands) like commonly observed in Miras over phase. In this poster, we shall discuss the spectro-photometric observations of this new Mira object and it's fundamental parameters.

ASI2015_715	Vishal Joshi	15:30 - 15:45	Oral

Detection of strong shock wave during the 2014 outburst of recurrent nova V745 Sco

D. P. K. Banerjee(PRL), N. M. Ashok (PRL), V. Venkataraman (PRL)

The third known outburst of recurrent nova V745 Sco was observed starting from day 1.3 after outburst in near-infrared. Our analysis showed the emergence of a strong blast wave generated by high velocity ejecta plowing into its surrounding environment. The shock does not show a free-expansion stage but rather shows a decelerative Sedov–Taylor phase from the beginning. The lack of a free-expansion stage favors V745 Sco to have a density enhancement around the white dwarf (WD) contributed by a RG wind. The shocked gas was is heated to temperature exceeding 108 K immediately after commencement of the outburst. The energetics of the outburst clearly surpass those of similar symbiotic systems like RS Oph and V407 Cyg which have giant secondaries. V745 Sco is the latest among the only six known novae till date showing gamma-ray emission during its outburst. The shock front formed during the outburst was probably site of gamma-ray generation. Our analysis also suggests that the WD in V745 Sco is very massive and a potential progenitor for a future SN Ia explosion.

ASI2015_664	Nimisha G. Kantharia	15:45 - 16:00	Oral

Evolution of radio emission at GMRT frequencies from the recurrent nova system V745 Scorpii

G. C. Anupama, N. Roy, P. Dutta, C. Ishwara-Chandra, A. Chitale, N. M. Ashok, D. P. K. Banerjee, T. P. Prabhu

In this paper, we present the light curve evolution of the radio emission at 610 MHz from the recurrent nova system V745 Sco. V745 Sco recorded its last outburst on 6 February 2014 and the system has been monitored at regular intervals at the radio frequency band of 610 MHz with the Giant Metrewave Radio Telescope (GMRT) since 9 February 2014. We present the light curves and preliminary model fits to the temporal evolution of the synchrotron emission from February to September 2014.

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ASI-2015 Parallel Sessions

Wednesday, 18 February 2015
GR & Cosmology - II [Chairperson: Archana Pai]
Time: 14:30 - 16:00 Venue: NCRA Auditorium

ASI2015_1034	Parameswaran Ajith	14:30 - 15:00	Invited

Gravitational-wave observations and multi-messenger astronomy

Celebrating its birth centenary, the General Theory of Relativity is the cornerstone of our understanding of high-energy astrophysics and cosmology. The last and perhaps the most intriguing prediction of this theory of gravity is the existence of gravitational waves. In the next decade we expect the emergence of a unique astronomical window based on direct observation of gravitational-wave signals. Gravitational-wave observations will complement, corroborate and perhaps challenge our understanding of the Universe gained from other windows of astronomy. This talk will summarize the prospects of extracting the physics and astrophysics some of the highest energy astronomical sources by combining gravitational-wave observations with electromagnetic observations.

ASI2015_838	Kanhaiya Lal Pandey	15:00 - 15:15	Oral

Reionization constraints on primordial magnetic fields

Tirthankar Roy Choudhury (National Centre for Radio Astrophysics-TIFR, Pune, India) Shiv K Sethi (Raman Research Institute, Bangalore, India) Andrea Ferrara (Scuola Normale Superiore, Pisa, Italy)

Search of magnetic fields in the IGM is one of the major goals for many upcoming projects such as LOFAR, MWA and SKA. The role of these magnetic fields as the likely seed field for the magnetic fields observed inside galaxies and cluster of galaxies, as well as the fact that the IGM magnetic field might trace and regulate structure formation in the early Universe, makes it considerably important. Primordial magnetic fields leave their signature on a range of cosmological processes and observables such as Faraday rotation of CMB polarization plane, weaklensing signals and Ly-alpha effective opacity etc. These fields can generate density perturbations in addition to the LCDM model in the post-recombination epoch. The matter power spectrum of these density perturbations dominates the standard LCDM matter power spectrum at small scales (k ~ 1–10 h/Mpc). This additional power can cause early formation of structures (e.g., galaxies) which consequently cause early reionization of the IGM. As of today, the main observational constraints on reionization come from the CMB polarization data (e.g., those from the WMAP and Planck experiments) and the quasar absorption spectra at z >= 5.5. Detailed models which are able to match these and a variety of other observations predict the reionization to be process extended over $6 < z < 15$. It has been shown that the presence of magnetic fields can affect the reionization history and alter the HI signal from epoch of reionization. In this work, we extend available detailed models of reionization by including magnetic fields and carry out a detailed mutliparameter MCMC analysis to compare with available data sets. The main goal is to check the level of constraints one can put on the primordial magnetic field using existing constraints on reionization. As a result of this analysis we get one of the strongest upper bound on primordial magnetic field strength.

ASI2015_529	Priyanka Singh	15:15 - 15:30	Oral

CMB distortion from circumgalactic gas

Subhabrata Majumdar, TIFR, Mumbai. Biman B. Nath, RRI, Bangalore. Joseph Silk, Institut d' Astrophysique, 75014Paris, France & The Hopkins University, USA

We study the Sunyaev-Zel'dovich (SZ) distortion of the cosmic microwave background radiation (CMBR) from extensive circum-galactic gas (CMG) in massive galactic halos. Recent observations have shown that galactic halos contain a large amount of X-ray emitting gas at virial temperature. We consider SZ distortion from the hot gas in those galactic halos in which the gas cooling timescale larger than the halo destruction timescale. We show that the SZ distortion signal from the hot gas in these galactic halos at redshifts z ~ 1-8 can be significant at small angular scales l ~ 10^4, and dominate over the signal from galaxy clusters. We also compute the stacked thermal SZ signal from CGM which is the cross-correlation power spectrum between the SZ effect and the distribution of galactic-halos and discuss the detectability of stacked SZ signal by combining SPT observation and optical surveys.

ASI2015_591	Sumanta Chakraborty	15:30 - 15:45	Oral

Evolution of Spacetime arises due to the departure from Holographic Equipartition in all Lanczos-Lovelock Theories of Gravity

T. Padmanabhan IUCAA

In the case of general relativity one can interpret the Noether charge in any bulk region as the heat content TS of its boundary surface. Further, the time evolution of spacetime metric in Einstein's theory arises due to the difference (Nsur−Nbulk) of suitably defined surface and bulk degrees of freedom. We show that this thermodynamic interpretation generalizes in a natural fashion to all Lanczos-Lovelock models of gravity. The Noether charge, related to time evolution vector field, in a bulk region of space is equal to the heat content TS of the boundary surface with the temperature T defined using local Rindler observers and S being the Wald entropy. Using the Wald entropy to define the surface degrees of freedom Nsur and Komar energy density to define the bulk degrees of freedom Nbulk, we can also show that the time evolution of the geometry is sourced by (Nsur−Nbulk). When it is possible to choose the foliation of spacetime such that metric is independent of time, the above dynamical equation yields the holographic equipartition for Lanczos-Lovelock gravity with Nsur=Nbulk. The implications are discussed.

ASI2015_635	D. Narasimha	15:45 - 16:00	Oral

Gravitational Lensing as a probe of Ultraviolet and Infrared modifications of Gravity

Satyabrata Sahu, D. Narasimha (Tata Institute of Fundamental Research) and Kinjalk Lochan (IUCAA)

General Relativity will necessarily have to be modified at higher energies (in the Ultraviolet) by some quantum theory of Gravity, the two foremost candidates for which now are String Theory and Loop Quantum Gravity (LQG). The study of black holes might yield a few insights for revealing the quantum nature of spacetime. In this light, we study gravitational lensing in the background of a recently proposed black hole solution in Loop Quantum Gravity by Modesto in both the strong and weak deflection regimes and present a sample consistency relation which could serve as a test of this model. Curiously, the quantum gravity corrections to the Schwarzschild metric in this model evade the 'mass suppression' effects (that the usual quantum gravity corrections are susceptible to) by virtue of one of the parameters in the model being dimensionless, which is unlike any other quantum gravity motivated parameter such as string tension or non-commutativity parameter. (This is possibly a disturbing aspect of the theory). Although the observational prospects do not seem to be very optimistic even for a galactic supermassive black hole case, time delay between relativistic images for billion solar mass black holes in other galaxies might be within reach of future relativistic lensing observations. Although there is no real theoretical compulsion for modification of gravity at extremely low energy scales (in the Infrared), the cosmological observations of dark energy point towards such a possibility. (If the various limits on variation of Fine Structure Constant are assumed to be consistent, they might imply a space dependence of the Fundamental Constants.) It has been recently argued by Grumiller that the most general theory of gravity at large distances (the Infrared) permits in addition to the usual terms in General Relativity (the Schwarzschild term and Cosmological constant term) a Rindler acceleration term which increases linearly with radial distance. We investigate gravitational lensing in the presence of Rindler term taking into account the consequent asymptotic non-flatness of spacetime which makes the standard definition of deflection angle and lens equation incorrect. We derive the generalized Rindler-Ishak deflection angle to complement some earlier bounds on Rindler term from Solar system tests and confirm that the solar system light bending bound is indeed weak. We also set up and solve the lens equation perturbatively and quantify the effect of Rindler term on the lensing observables. We find that with the galactic supermassive black hole as the lens, corrections to lensing observables like angular location of Einstein Ring can be probed with future lensing missions. ~

ASI2015_1038	Anil Bhardwaj	18:30 - 19:30	Public Talk

Indian Planetary Missions

The Mars Orbiter Mission (MOM) concept began with a feasibility study in 2010, after the successful laungh of Chandrayaan-1 in 2008. The objective of the Mars Oribiter Mission is two-fold: (i) to showcase India's rocket laungh capabilities and to develop the technologies required for design, planning, management and operations of an interplanetary mission, and (ii) to explore Mars' surface features, morphology, mineralogy and Martian atmosphere using indigenous scientific instruments. In this talk, the speaker will describe about ISRo's interplanetary missions, in particular about Mars Orbiter Mission(MOM).

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ASI-2015 Plenary Session: Future Initiatives

Thursday, 19 February 2015 [Chairperson: P. Sreekumar]

Time: 09:00 - 11:00 Venue: Chandrashekhar Auditorium

ASI2015_1022	B Eswar Reddy	09.00 am-9.30 am	Plenary

India's Participation in the TMT International Observatory - An update to ASI

Since my last update to the society at IISER Mohali India TMT made a significant progress both in-terms of financial approvals and our readiness to provide in-kind contributions to the TIO. I will present current status of this next generation optical and IR ground based facility "the Thirty Meter Telescope (TMT) International Observatory (TIO) to be built atop Mauna Kea, a dormant volcanic mountain, Hawaii, USA which is one of the best astronomical sites in the world. TMT primary consists of 492 segments each measuring 1.44-m diameter. India's participation in the project is mostly through in-kind contribution by developing some of the key systems to the project.

ASI2015_1044	Philip Diamond	09.30 am-10.00 am	Plenary

The Square Kilometre Array: a physics machine for the 21st Century

The SKA, the next-generation radio telescope, is currently in the detailed design phase with scientists and engineers from 11 partner nations, including India, participating in a global effort coordinated by the SKA HQ at Jodrell Bank Observatory in the UK. I will describe the science drivers for the SKA, which include: investigating the nature of gravity, probing dark energy and dark matter, understanding the formation and evolution of the very first stars and galaxies after the Big Bang, and much more. I will also provide an update on the project status and the timeline for construction and operations.

ASI2015_1012	Dipankar Banerjee	10.00 am-10.30 am	Plenary

Indian Space mission to probe sun: Aditya 1

ISRO is most likely upgrading its planned Aditya-1 solar mission from a single payload to a muti-payload observatory. It is proposed to be placed at Earth-Sun L1 point - a place where no Indian space craft has gone before. The observatory will host multi-wavelength instruments with an optical/IR coronagraph, EUV disk imager, two x-ray spectrometers and couple of particle detectors. In this talk I will give an overview on the payloads and major scientific objectives of this mission along with the current status of the mission.

ASI2015_992	Bala R Iyer	10.30 am-11.00 am	Plenary

Beyond Detection to Gravitational Wave Astronomy

The second-generation kilometer scale laser interferometric Gravitational Wave (GW) detectors Advanced LIGO and Advanced Virgo will be operational in a few years and are expected to make several detections per year. The first detections will open up a fundamentally new observational window to the Universe with implications for astrophysics, cosmology and fundamental physics. Inaugurating GW astronomy requires extension of the existing LIGO-Virgo network to a global network including observatories like LIGO-India to provide good sky localization for the GW sources. LIGO-India will thus play a key role in locating and deciphering these sources. The status of LIGO-India project and the exciting research opportunities arising from this mega project on Indian soil in a variety of disciplines in basic science, high end technology and challenges in computations will be finally indicated.

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ASI-2015 Parallel Sessions

Thursday, 19 February 2015
Extragalactic - III [Chairperson: T. Roy Choudhury]
Time: 11:30 - 13:00 Venue: NCRA E-LAB

ASI2015_1036	Nissim Kanekar	11:30 - 12:00	Invited

The Nature of High-redshift Damped Lyman-alpha Systems

Damped Lyman-alpha Absorbers (DLAs) are the high-redshift counterparts of today's normal gas-rich galaxies, with high HI column densities, N_HI >= 2e20 per cm^2. Despite their acknowledged importance in the context of galaxy evolution and thirty years of research, the nature of high-redshift DLAs remains an open issue. In this talk, I will describe results from a slew of our studies over the last decade, probing the ISM temperature phases of DLAs, their atomic and molecular gas masses, and their star formation rates.

ASI2015_508	Gargi Shaw	12:00 - 12:15	Oral

Effect of metallicity and cosmic ray ionization rate on the 21 cm spin temperature.

Gary Ferland University of Kentucky, USA

Most of our knowledge about the distribution of neutral atomic hydrogen in the ISM of the Milky Way and other galaxies comes from 21 cm observations which originates from the transition between the hyperfine levels within the 1S term of H0. If the level populations are collisionally dominated in the absence of other non-thermal processes, the 21 cm line will trace the kinetic temperature. However, the level populations can be affected by non-thermal radiative processes. Here we present a number of numerical simulations of environments, using the spectral simulation code Cloudy, varying the metallicity and cosmic-ray ionization rate with a detailed treatment of the physical processes that determine level populations within H0. This includes detailed Lyman line transfer and the effects of cosmic-ray excitation and continuum pumping. Our simulations show that the 21cm spin temperature is certainly dependent on the metallicity and the cosmic ray ionization rate.

ASI2015_602	Narendra Nath Patra	12:15 - 12:30	Oral

Modeling HI distribution and kinematics in the edge-on dwarf irregular galaxy KK250

Arunima Banerjee(IUCAA) Jayaram N Chengalur (NCRA) Ayesha Begum Sinha (IISER, Bhopal)

We model the observed vertical distribution of the neutral hydrogen (HI) in the faint (M$_{\rm B} \sim -13.7$~mag) edge-on dwarf irregular galaxy KK250. Our model assumes that the galaxy consists of axi-symmetric, co-planar gas and stellar discs in the external force-field of a spherical dark matter halo, and in vertical hydrostatic equilibrium. The velocity dispersion of the gas is left as a free parameter in the model. Our best fit model is able to reproduce the observed vertical distribution of the HI gas, as well as the observed velocity profiles. The best fit model has a large velocity dispersion (~ 22~\kms) at the centre of the galaxy, which falls to a value of ~ 8~\kms\ by a galacto-centric radius of 1 kpc, which is similar to both the scale-length of the stellar disc, as well as the angular resolution of the data along the radial direction. Similarly we find that the thickness of the HI disc is also minimum at ~ 1kpc, and increases by about a factor of ~ 2 as one goes to the centre of the galaxy or out to ~ 3kpc. The minimum intrinsic HWHM of the HI vertical distribution in KK250 is ~ 350pc. For comparison the HWHM of the vertical distribution of the HI in the solar neighbourhood is $\sim 70-140$~pc. Our results are hence consistent with other observations which indicate that dwarf galaxies have significantly puffier gas discs than spirals.

ASI2015_773	Girish Kulkarni	12:30 - 12:45	Oral

The Jeans Scale of the Inter-Galactic Medium

Joseph Hennawi, Jose Onorbe (Max Planck Institute for Astronomy, Heidelberg, Germany); Alberto Rorai (Institute of Astronomy, University of Cambridge, Cambridge, England); Volker Springel (Heidelberg Institute for Theoretical Studies, Heidelberg, Germany)

The intergalactic medium (IGM) is a rich repository of the past. In particular, constraints on its thermal state at redshifts $z=2$--4 from the Lyman-α forest are invaluable in understanding processes such as the IGM reionization and galaxy formation over a much wider redshift range. Significant observational efforts have yielded such constraints in the last fifteen years, on the temperature T_0 of the IGM at its mean density and the slope γ of its temperature-density relation, but these measurements are still confusing and contradictory. This confusion arises because all of these constraints come from longitudinal, one-dimensional data---viz., Lyman-α absorption lines in individual spectra of background quasars---but are degenerate with the transverse, three-dimensional structure of the IGM, which needs to be measured or marginalised over for proper inference. Therefore, a measurement of the pressure smoothing scale (``Jeans scale") of the IGM promises to bring robustness on the constraints on T_0 and γ by introducing three-dimensional information. In my talk, I will explain the degeneracy between T_0, γ and the Jeans scale, and show why a measurement of the Jeans scale is important. I will present a generalisation of simple linear theory understanding of pressure smoothing that serves as a new characterisation of the IGM Jeans scale. Further, I will describe an observational technique to measure the IGM Jeans scale using pairs of quasar spectra. Finally I will present the first measurements of the Jeans scale, and discuss implications for IGM physics.

ASI2015_572	Rupal Basak	12:45 - 13:00	Oral

The prompt emission of gamma-ray bursts: signature of the thermal component

A. R. Rao Tata Institute of Fundamental Research

Gamma-ray bursts (GRBs) are explosive events possibly marking the collapse of massive stars or merging of compact objects which lead to the formation of compact stellar-mass objects. The compact object acting as a central engine, drives a bipolar relativistic jet. The initial burst, known as prompt emission lasts for simms (short-GRBs) to tens of seconds (long-GRBs), and shows rapid variability. This is followed by a longer and smoother afterglow phase. Understanding the radiation mechanism particularly that of the prompt phase holds the key to understand the central engine. It is believed that the radiation during the prompt emission is an optically thin synchrotron radiation. However, there are now mounting evidences of a thermal emission along with the non-thermal component. Our discussion will include the following. - Study the shape and evolution of the thermal emission in bright GRBs. Particularly, we will show that the thermal emission consists of two smoothly evolving correlated blackbodies (Basak \& Rao 2013, ApJ 768, 187; Rao, Basak \& Bhattacharya et al. 2014, RAA 14, 35). - GRB~090618 is one rare case where we find a simultaneous Swift/BAT and Swift/XRT observation. The XRT, being a focusing X-ray detector, has an order of magnitude better energy resolution than the BAT. We do identify the two evolving blackbodies in the simultaneous data (Basak \& Rao 2014a, ApJ, submitted). Our finding is reinforced by a similar observation in GRB~130925A (Basak \& Rao 2014b, ApJ, submitted). Thanks to the ultra-long duration of the prompt phase (2 hours), this burst could be studied with high resolution detectors of NuSTAR and Chandra. The data analysis again reveals the presence of the two blackbodies, and they fairly extend till the late afterglow phase. - A comparison of the spectral evolution of the two GRBs shows a remarkable similarity with different time scales. We suggest that the spectral evolution seen in both these GRBs is a tail emission of the late prompt phase rather than the early afterglow phase. The longer time scale of GRB~130925A is possibly due to a larger progenitor, and a fainter afterglow. This is supported by the finding of low density environment of the burst. We suggest that a fast spine with a slow sheath structure of GRB jet is responsible for all the spectral features we obtain in our analysis. - Finally, we shall discuss the possible future projects e.g., analysis of long-GRBs with overlapping BAT-XRT observation, exploring other physical models, detailed analysis of the prompt, afterglow and burst environment of a few representative GRBs of different classes, and finding the signature of the different environments on the spectrum.

ASI-2015 Parallel Sessions

Thursday, 19 February 2015
Instrumentation & Techniques - III [Chairperson: N. Udaya Shankar]
Time: 11:30 - 13:00 Venue: NCRA East Campus

ASI2015_961	R.C. Rannot	11:30 - 12:00	Invited

HiGRO - The Indian High Altitude Gamma-Ray Obse

The Himalayan Gamma Ray Observatory (HiGRO) will be a national facility at Hanle in Ladakh region of the Himalayas (Lat.: 32° 46' 46" N, Long.: 78° 58' 35" E alt.: 4270m) for observations of the celestial Very High Energy (VHE) gamma-ray sources. When fully operational it will deploy two low threshold energy gamma - ray telescopes based on the Atmospheric Cherenkov Technique (ACT). One of the telescopes namely HAGAR (High Altitude GAmma Ray) uses wavefront sampling methodology of the ACT to study VHE gamma-ray emissions. It has been operational for the last 6 years and more than 10 VHE gamma-ray sources have been observed for about 3300 hours. These sources include Crab Nebula, Mrk421, Mrk501, 1ES1959+650, 1ES2344+514, H1426+428, 1ES1218+304 and 3C454.3. The second telescope of the HiGRO is the Major Atmospheric Cherenkov Experiment (MACE) which is based on the imaging atmospheric Cherenkov technique. It is in advanced stage of its installation and its various mechanical parts are being transported to its site at Hanle after their integrated trial runs at ECIL campus in Hyderabad. The MACE deploys a 21m diameter tessellated parabolic mirror with 1088 photomultiplier tubes based imaging camera at its focal plane. Monte Carlo simulation studies of the MACE show that it will be possible to record images of extensive air showers above 20 GeV with an overall cosmic-ray event rate of about 450Hz. Further, the low threshold energy of the MACE will help us to study temporal and spectral features of the northern Fermi/LAT detected VHE sources with better statistics, angular as well as energy resolution. We expect to record the first VHE photons by early 2016.

ASI2015_417	Nagendra Neerudu	12:00 - 12:15	Oral

Development of high altitude balloons for scientific applications

Suneel Kumar Buduru, Devendra K Ojha, Sakram Korra, Stalin Peter Godi, Anmi Reddy V, Anand D, Kulkarni P M

First-ever, scientific balloon of volume 61,013 m3 was designed and fabricated from Tata Institute of Fundamental Research Balloon Facility (TIFR-BF), Hyderabad have been reaching mesospheric altitude. We made three consecutive balloon flights from TIFR-BF during January 2014 and they reached a record altitude of 51 km with suspended load of 10 kg. This new development of high altitude balloon can be used for atmospheric and astronomical observation in near future. In this presentation, we will discuss the detailed information on the balloon fabrication, development of launch hardware, flight control instruments and launch technique for these mesospheric balloon flights.

ASI2015_584	Shashikiran Ganesh	12:15 - 12:30	Oral

EMCCD based Imaging polarimeter for 1.2m Mt Abu telescope.

Shashikiran Ganesh (PRL), Ashish Mishra (PRL/IIST), S N Mathur(PRL), K S Baliyan(PRL), Sunil Chandra (PRL), Kumar Venkataramani (PRL), Navpreet Kaur (PRL)

A new imaging polarimeter has been designed and built at PRL for carrying out optical band imaging polarimetric observations at the 1.2m telescope of the Mount Abu Infrared Observatory. A half-wave plate rotating at known frequency is used as a modulator and a Foster prism is used as an analyser for measuring the polarization. A 1K x 1K EMCCD is used as detector. The second beam (partially polarized output from the foster prism) is used for auto-guiding. Modulation can be carried out in both rapid as well as slow modes. The rapid modulation technique is used for point source studies - e.g. monitoring of blazars for variability in polarization and intensity. Slow modulation technique (used with or without any on-chip-binning) is used for observing extended sources such as comets where spatial resolution is also important. The instrument has a 12 position filter wheel equipped with the Johnson/Cousins broad band and the Hale-Bopp (Comet filters) narrow band sets. The instrument has been tested in the lab (for 100% polarization using a glan prism) and also at the telescope. We shall describe the instrument and present some of the results obtained.

ASI2015_614	Jyotirmay Paul	12:30 - 12:45	Oral

Performance Analysis of iRobo-AO system and Laboratory calibration unit

A.N.Ramaprakash , Mahesh Burshe, Pravin Chordia, Hillol Kanti Das , Abhay Kohok, Pravin Khodade, Deepa Modi, Sujit Punnadi, Chaitanya Rajarshi

Earth's atmospheric turbulence can be taken care by Adaptive optics (AO) system through reconstruction of wavefront in real time when astronomical objects are observed using ground based telescopes. AO system is now successfully used in numerous big observatories with large overheads. With affordable overheads for small telescopes (1m to 3m) a compact, low cost, automated adaptive optics Robo-AO system is jointly developed by Caltech, USA and IUCAA, India for the Palomar 60-inch telescope. A second version of Robo-AO called iRobo-AO is currently under development at IUCAA for deployment on the 2m telescope at IUCAA Girawali Observatory in visible and near infrared band. This paper summarizes alignment and laboratory calibration with an internal telescope simulator and performance analysis of iRobo-AO with Shack-Hartmann wavefront sensors, continuous facesheet deformable mirrors and Rayleigh scattered laser guide star at 10km above the ground. Adaptive optics system performance is determined in terms of Strehl ratio, resolution and increased sky coverage.

ASI2015_549	Brajesh Kumar	12:45 - 13:00	Oral

The upcoming 4-m International Liquid Mirror Telescope (ILMT) project

Jean Surdej, Paul Hickson, E. Borra, Francois Finet, J.P. Swings, Serge Habraken and A.K. Pandey

The International Liquid Mirror Telescope (ILMT) is a collaborative project between Belgium, India, Canada and Poland. It consists of a 4-m diameter mirror with a f/2 focal ratio. The ILMT will be set up at the Devasthal Observatory (79º 41' 04" E, +29º 21' 40", altitude ~2450m), ARIES. With a very simple structure, combined with a 4k x 4k CCD camera and an optical corrector, this telescope will work in the Time Delay Integration mode taking advantage of the best seeing conditions, i.e. those prevailing at the zenith. It will image a strip of sky in the g', r' and i' spectral bands, having an approximate width of 27 arcminutes in declination and length of 24 hours in right ascension. The ILMT will thus perform a deep survey of a long and narrow strip of sky by looking at stars, galaxies, AGNs, SNe, asteroids, space debris, etc. that are crossing its field of view. The survey with the ILMT will be mainly dedicated to photometric and astrometric variability studies. During the past few years, a number of experiments have been performed such as spin casting of the primary mirror, optical quality tests of the mercury surface and mylar film experiments, etc. to solve many issues and technical problems inherent to this project. Major parts of the ILMT have already reached the Devasthal Observatory and installation will start soon, just after completion of the enclosure construction. In this talk, we will present an overview and the present status of this new upcoming facility.

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ASI-2015 Parallel Sessions

Thursday, 19 February 2015
Sun and Solar System - III
Time: 14:30 - 16:00 Venue: NCRA Auditorium

ASI2015_710	Durgesh Tripathi	14:30 - 15:00	Invited

The Solar Ultraviolet Imaging Telescope (SUIT) for Aditya-L1 mission

Durgesh Tripathi, A. N. Ramaprakash and the SUIT team

The Solar Ultraviolet Imaging Telescope is an imaging telescope on board ISRO's proposed Aditya-L1 mission, that will be placed in an halo orbit around the first Lagrangian point (L1) of the Sun-Earth system. SUIT has been designed to record full disk observations of the Sun between 200-400 nm wavelength range using eight narrow band and three broadband filters. The main science goals SUIT will address will be related to the dynamic coupling of the solar atmosphere, various eruptive events and sun climate relations. SUIT will provide continuous observations with sufficiently high spatial and temporal resolution that can address issues like motion of the shock-fronts, heating of chromosphere by current sheets, MHD waves, magnetic reconnection etc. Hence, it has the potential to provide the best opportunity to study the dynamics and coupling of the chromosphere and the transition region. Additionally, SUIT will for the first time provide spatially resolved solar spectral irradiances which is of utmost importance for the understanding of Sun-climate relationship. The talk will high light some of the important questions SUIT is designed to address.

ASI2015_588	Nishtha Sachdeva	15:00 - 15:15	Oral

Constraining Near-Earth Mhd Turbulence Levels Using Forbush Decrease Precursors

Prasad Subramanian(Iiser Pune), Sunil Gupta, H. M. Antia And The Grapes-3 Team (Tifr, Mumbai)

Earth-Directed Coronal Mass Ejections and their associated shocks can cause sudden dip in the intensity of galactic cosmic rays observed at the Earth; these are called Forbush Decreases. Forbush decrease precursors are anomalies in the cosmic ray intensities that are detected before the Forbush decrease event. Charged particles with low pitch angles escape the mirroring effect of the emhanced magnetic fields (which create the Forbush Decrease). Such precursor decreases can give advance warnings of the turbulence levels near Earth and arrival time and strength of the shock hitting the Earth. Turbulence in the near-Earth space environment ought to destroy the identity of such precursors via pitch angle scattering. We therefore seek to constrain the upstream turbulence levels by studying typical precursor lifetimes and link it to observations with the GRAPES-3 Muon Telescope.

ASI2015_551	Upendra Kumar Singh Kushwaha	15:15 - 15:30	Oral

Large-scale implosion in coronal loops during the pre-flare phase of an M6.2 flare and associated failed eruption of a filament

Bhuwan Joshi Udaipur Solar Observatory, PRL,Udaipur-313001, India and Astrid M. Veronig Kanzelhöhe Observatory/Institute of Physics, University of Graz, Universittäsplatz 5, A-8010 Graz, Austria

In this paper, we present a comprehensive multi-wavelength study of an M6.2 flare which was associated with a failed eruption of a filament using TRACE, RHESSI, and NoRH observations. The pre-flare phase of this event is characterized by spectacular large-scale contraction (implosion) of overlying EUV coronal loops during which the loop system was subjected to an altitude decrease of ~20 Mm (40% of the initial height) for an extended span of ~30 min. This contraction phase is accompanied by the sequential brightening in low-lying loops in the core of flaring region which is spatially correlated with HXR (up to 25 keV) and MW sources, indicating the occurrence of localized events of magnetic reconnection in the source region before the prominence eruption and associated M-class flare. With the onset of the impulsive phase of the M6.2 flare, we detect HXR and MW sources that exhibit intricate temporal and spatial evolution in relation with the fast rise of the prominence. Following the flare maximum, the filament eruption slowed down and subsequently confined within the large overlying active region loops; the event did not lead to the coronal mass ejection (CME). During the confinement process of the erupting prominence, we detect MW emission from the extended coronal region with multiple emission centroids which likely represent emission from hot blobs of plasma formed after the collapse of the expanding flux rope and entailing prominence material. RHESSI observations reveal high plasma temperatures (~29–32 MK) and substantial non-thermal characteristics with electron spectral index (δ~5) during the impulsive phase. The evolution of thermal energy correlates nicely with the cumulative integral of non-thermal energy which suggest that the energy of accelerated particles is efficiently converted to heat and kinetic energy of localized flaring plasma showing the effective validation of the ‘Neupert effect’.

ASI2015_826	Nandita Srivastava	15:30 - 16:00	Invited

CME -CME interaction: Kinematics & Consequences

Wageesh Mishra Udaipur Solar Observatory, PRL

The launch of STEREO spacecraft with the capability of heliospheric imaging alongwith in-situ observations have provided us an opportunity to track and understand the propagation of CMEs from the Sun to the Earth and beyond. In this talk, I will present the results of a study of several cases of interaction of CMEs observed by STEREO/HI instruments. These CMEs were launched in quick succession and interacted as they propagated in the inner heiosphere. In particular, we investigate the nature of their collision /interaction and the dependence of the arrival time of these CMEs at the in-situ spacecraft, on the post-collision kinematics. The nature of collision and exchange of momentum for these cases of interacting CMEs will be presented. Further, we examine the signatures of collision and interaction of CMEs in in-situ observations. The consequences of interaction in strengthening the geoeffectiveness of CMEs is also looked into.

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ASI-2015 Parallel Sessions

Thursday, 19 February 2015
Stars, The Galaxy and its Neighbours - III [Chairperson: Ranjan Gupta]
Time: 14:30 - 16:00 Venue: NCRA E-LAB

ASI2015_633	Kanak Saha	14:30 - 15:00	Invited

Is there a classical bulge in our Milky Way?

Kanak Saha

COBE/DIRBE satellite revealed that the central region of our Milky Way hosts a boxy shaped bulge rather than a spheroid. A number of evidences have already established that the Milky Way also hosts a stellar bar in the disk mid-plane and the boxy bulge is thought to have formed as a result of buckling instability of the bar. N-body modelling of the kinematic data from recently completed surveys such as BRAVA, VVV, etc. indicates that our Milky Way is a pure disk galaxy without a classical bulge. However, the stellar population and metallicity gradients in the bulge region do not rule out the existence of a classical bulge. After giving a brief overview of the current status of the Milky Way's bulge, I will discuss some new results that might shed some new light on this ongoing debate.

ASI2015_473	Arabindo Roy	15:00 - 15:15	Oral

The Line-mass Power Spectrum of Interstellar Filaments - A Possible Link to the IMF ?

Roy, A., Andr'e, Ph., CEA, Saclay, France Arzoumanian, D., et al., IAS, Orsay, France

Herschel observations (Konyves et al. 2010 & Andre' et al. 2013) have revealed that a majority of prestellar cores (>70%) are formed along thermally supercritical filaments due to gravitational instability. The virtue of being supercritical, however, is not a sufficient condition for the formation of prestellar cores because in theory, a supercritical filament (M_line > 2Cs^2/G) collapses radially into a line without any fragmentation. The presence of longitudinal line-mass perturbation modes along the z axis of the filaments combined with self-gravity assists in the formation of cores. Interestingly, the statistical properties of the perturbations are directly linked to the statistics of prestellar core masses. Analytically, Inutsuka (2001) showed that a line mass fluctuating field along a filament characterized by a power spectrum slope of -1.5 generates a mass spectrum of collapsed cores i.e., dN/dM proportional to M^-2.5, similar to the Salpeter mass function. Our analysis on the Herschel Gould Belt Survey dust emission data has revealed that the line mass fluctuations along the long axes of filaments (Roy et al. 2014) have a characteristic 1-D power spectrum slope of -1.7+/-0.3. The power spectrum slope bears a striking similarity with 1-D Kolomogorov turbulence spectrum of -1.67. The observational derivation of the characteristic power spectrum slope may have implications on our understanding of the IMF. The observationally derived power spectrum slope (-1.7) in the present study suggests that thermally supercritical filaments will fragment into a core population whose mass function approaches dN/dM proportional to M^-2.3. This is very close to the Salpeter slope pointing to the possibility that the density perturbations due to turbulence is prerequisite for generating a Salpeter-like mass function toward the high mass end. References Andre', P., Di Francesco, J., Ward-Thompson, D., et al. 2013, PPVI Inutsuka, S.-i. 2001, ApJ, 559, L149 K¨onyves, V., Andr´e, P., Men'shchikov, A., et al. 2010, A&A, 518, L106 Roy, A., Andre', P., Arzoumanian, D., et al. 2014, to be submitted

ASI2015_661	Lab Saha	15:15 - 15:30	Oral

Radiative recombination structures in galactic supernova remnants

T. Ergin (1,2), A. Sezer (1,2), P. Majumdar (3), A. Chatterjee (3), A. Bayirli (2), E. N. Ercan (2) (1) TUBITAK Space Technologies Research Institute,Ankara, Turkey (2) Physics Department, Bogazici University, Istanbul, Turkey (3) Saha Institute of Nuclear Physics, Kolkata, India

The recent X-ray observations have revealed that some of the galactic gamma-ray-emitting supernova remnants (SNRs) have overionized plasmas. G31.9+0.0 (3C391) is one of the such galactic mixed-morphology SNRs observed in GeV gamma-rays by the Fermi Gamma Ray Space Telescope LAT (Fermi-LAT), as well as in the 0.3- 10 keV X-ray band by Suzaku. We analyzed the Suzaku data of 3C391 and we first discovered radiative recombination structures of silicon and sulfur from 3C391. We have also analysed gamma-ray data of 3C391 taken with Fermi-LAT and it was detected in GeV gamma rays with a significance of $\sim 18\sigma$ and we showed that the GeV emission is point-like in nature. The GeV gamma-ray spectrum was shown to be best explained by the decay of neutral pions assuming a broken power-law proton distribution. Here, we will discuss the possible origin of the of radiative recombination structures of two such SNRs including 3C391 and origin of gamma rays.

ASI2015_585	Pragati Pradhan	15:30 - 15:45	Oral

Broadband properties of accretion powered X-ray pulsars: a study with Suzaku

Biswajit Paul Raman Research Institute, Sadashivnagar, Bangalore 560080, India B.C Paul North Bengal University, Raja Rammohanpur, District Darjeeling, 734013, West Bengal, India

We will present a comprehensive study of the hard X-ray timing and spectral properties of accreting X-ray pulsars, most of which are high mass X-ray binaries (HMXBs). Using Suzaku observations we have examined the energy dependence of the pulsations upto highest detectable energies in these sources and compare the energy dependence with the X-ray luminosity and the magnetic field strength of these sources, if known. Similarly, the hard X-ray spectral properties of the sources are examined against the X-ray luminosity and the magnetic field strength. These measurements give valuable insight into physical properties of the emission region in accreting pulsars. In the lower energy band, we measured the emission lines, the absorbing column density, and the reprocessed soft X-ray emission. All of these together show the variety of the physical environment in the X-ray pulsars.

ASI2015_640	Prasanta Bera	15:45 - 16:00	Oral

Mass–radius relation of strongly magnetized white dwarfs: nearly independent of Landau quantization

Prof. Dipankar Bhattacharya, IUCAA, PUNE

Super-Chandrasekhar mass white dwarfs are believed to be the progenitors of over-luminous type-Ia supernovae. Modification of equation of state in presence of strong magnetic field has been considered to be a probable explanation of single degenerate system. We study the strongly magnetized white dwarf configurations in a self consistent manner. We compute static equilibria of white dwarf stars containing strong poloidal and toroidal magnetic field, and present the modification of white dwarf mass–radius relation caused by the magnetic field. We find that a maximum white dwarf mass of about 1.9M_Sun may be supported if the interior field is as strong as approximately 10^10 T. This mass is over 30 per cent larger than the traditional Chandrasekhar Limit. The equation of state of electron degenerate matter can be strongly modified due to Landau quantization at such high magnetic fields.We find, however, that this does not significantly affect the structure of the white dwarf.

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ASI-2015 Plenary Session: High energy universe

Chairperson: R. Srianand

Friday, 20 February 2015

Time: 09:00 - 10:30 Venue: Chandrashekhar Auditorium

ASI2015_1060	Andrew King	9.00 am-9.30 am	Plenary

How Do Supermassive Black Holes Accrete?

I review what we know about supermassive black hole feedback and accretion. I suggest new ways forward and how we might test them observationally.

ASI2015_636	K P Singh	9.30 am-10.00 am	Plenary

X-raying the zoo of Active Galactic Nuclei

I will present a brief overview of the X-ray properties of Active Galactic Nuclei (AGN) of all types. The presentation is based on the most popularly accepted unified picture of AGN. Characteristics of X-ray spectra and X-ray variability obtained from various X-ray satellites will be presented and discussed. The future potential of upcoming X-ray astronomy satellites, like ASTROSAT and ASTRO-H will be looked at. I shall end by indicating the crucial role of AGN in understanding the cosmic X-ray background.

ASI2015_932	Sudip Bhattacharyya	10.00 am - 10:30 am	Plenary

X-ray binary: a world of extremes

X-ray binaries are accreting neutron stars and stellar-mass black holes. They primarily emit in X-ray wavelengths. I will explain why they are unique natural laboratories to probe some extreme aspects of the universe, and how some of their observational features can be used as tools for such probing. I will also discuss the current status of research in this field and what can be done in coming decades.

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ASI-2015 Thesis presentations

Friday, 20 February 2015

Time: 11:00 - 13:00 Venue: Chandrashekhar Auditorium

ASI2015_516	Prabhakar Tiwari	11.00-11.15

Observations of Large Scale Anisotropy and Cosmological Models

Prabhakar Tiwari

The observable Universe is simply huge! ~10^{26} meters in every direction, ~14 billion years old and contains ~10 ^{80} hydrogen atoms. The modern cosmology is the science of the entire Universe. We,here on a small planet, can only assume that the Universe is knowable and physics is followed everywhere in the same manner. Furthermore it is reasonable to assume that the observable Universe is statistically same for all observers, located anywhere in the Universe. Today, we demand this uniformity as “Cosmological Principle” which assumes homogeneity and isotropy at large distance scales. This thesis is a critical examination of the cosmological principle. In the thesis we review the present observations of large scale anisotropy and discuss possible theoretical models to explain these observations.

ASI2015_550	Susanta Kumar Bisoi	11.15-11.30

Solar and Solar Wind Studies Using Ground and Space Based Observations

P.Janardhan Physical Research Laboratory, Ahmedabad

Using synoptic magnetograms from the ground-based NSO/KP and space-based SoHO/MDI database, we examined solar photospheric magnetic fields for Cycles 21, 22, and 23. Specifically, we examined polar magnetic fields at high latitudes (78o-90o) in both the hemispheres and found a steady decline in the unsigned polar fields from the late declining phase of Cycle 22 to the maximum of Cycle 23. We found a good correlation, in Cycle 23, between the long-term changes in the unsigned polar fields and changes in meridional flow speeds during Cycle 23. In addition, our observations of continuously weaker polar fields, in Cycle 23, led us to believe that these weaker fields were the cause of the extremely prolonged minimum, at the end of Cycle 23 and would lead to a weaker Cycle 24. We undertook investigation of quasi-periodic variations in solar photospheric fields in the build-up to one of the deepest solar minima experienced in recent times. We found a hemispheric asymmetry in quasi-periodicity of the photospheric fields, confined to the latitude range 45o to 60o. This observed asymmetry, when coupled with the fact that both solar fields above 45o and micro-turbulence levels in the inner-heliosphere have been decreasing steadily since the early to mid-1990s suggested that active changes occurred in the solar dynamo around this time. These changes, in turn, probably initiated the build-up to the deep solar minimum around mid-1990s. Any long term changes in solar photospheric fields during solar cycles must leave its signatures in the solar wind and can be effectively detected through interplanetary scintillation (IPS) measurements. We used IPS observations at 327 MHz, obtained between 1983 and 2009, to investigate the long-term temporal variations in the scintillation levels and found a steady and significant decline in the micro-turbulence levels in the entire inner heliosphere, which was started since ~1995. This large-scale heliospheric IPS signature, coupled with the similar steady decline of solar polar magnetic fields since ~1995, provide a consistent result that showed the buildup to the deepest solar minima, experienced in the past 100 years, actually began in a decade earlier, that is, in the early- to mid-1990s. We also studied a pair of sudden impulses (SI) in the Earth's magnetic fields, first identified at the Indian magnetic observatories, on 23 – 24 April 1998. We discussed the close correlations between the SI pair and the corresponding variations in solar wind density, while the solar wind velocity and the southward component of the interplanetary magnetic field (IMF-Bz) did not show any correspondence. Further, we also showed that it is possible for a rear-side solar flare to propagate a shock towards the earth.

ASI2015_547	Prashanth Mohan	11.30-11.45

Models of Observational Signatures of Black Holes

Arun Mangalam, Indian Institute of Astrophysics, Bangalore.

Light curves from active galactic nuclei (AGN) indicate aperiodic variability over a wide range of timescales: $\sim$ 100 s to a few 100 s in the γ-rays; $\sim$ 1000 s to a few hours in the optical/UV and X-rays; less than a day to a few days in the optical and radio and months to years in the optical and radio depending on the type of AGN. The variability could be attributed to orbiting inhomogeneities in the vicinity of a supermassive black hole (SMBH) of mass $\sim$ $10^6 - 10^9 M_{\odot}$. Some key issues in this context include the cause for variability over this diverse range of timescales, the presence of quasi-periodic oscillations (QPOs) in this variable emission and how one can use this information to constrain the SMBH mass $M_{\bullet}$, spin a, emission region size r and other physical quantities. To address these, we developed theoretical models of disk and jet based variability involving both geometrical and physical effects on emission from the vicinity of the SMBH. General relativistic effects including light bending, time delay, aberration, gravitational and Doppler shifts modulate the simulated light curve. In these models, there is a natural development of a power law shape with slopes in the range ~-1.5 to -3 in the simulated power spectral density (PSD) along with a weak to strong QPO, attributable to orbital signatures; the strength of which depends on the number of orbital features - a single feature results in a strong QPO which becomes weaker for multiple emitters. These are supplemented by a timing analysis of the multi-wavelength AGN light curves. For this, we developed a suite of time series analysis techniques consisting of the periodogram, Lomb-Scargle periodogram, multi-harmonic analysis of variance periodogram and wavelet analysis. A data characterization and search strategy is applied to optical and X-ray light curves from AGN to infer the shape of the PSD and its parameters followed by the statistical identification of any characteristic break frequencies or QPOs. We thus used the disk and jet models of orbital signatures to place constraints on $M_{\bullet}$, a and r with inputs from the statistical analysis of observed light curves.

ASI2015_561	Laxmikant Chaware	11.45-12.00

Multiwavelength Study of Galaxies Using Deep Survey Fields

Laxmikant Chaware Pt. Ravishankar Shukla University, Raipur

The deep images of six LFC fields at our disposal with excellent SNR and availability of complementary data for the fields in the public domain from the other surveys motivated us to (i) study the properties of the isophotal shapes of early-type galaxies (E/SO) to very faint outer regions, well beyond the levels reached by previous studies of this type. And, (ii) to explore Low Surface Brightness (LSB) galaxies which emit much less light per unit area than normal high surface brightness galaxies do and remain undetected in most of the observations because of the difficulty in detecting them against the night sky brightness. These exploit the fact that the data has been obtained through very long exposures with a 5m telescope, and therefore provides an opportunity to study low surface brightness regions of a large sample of galaxies. In this thesis work we generated photometric catalogs for all the objects that were detected in the images of six LFC fields. We performed surface photometry and bulge-disk decomposition for a large sample of galaxies chosen from each field. We carried out a redshift survey to derive absolute magnitudes and physical sizes of the galaxies using the 2dF/AAOmega multi-fiber system on the 4m Anglo Australian Telescope (AAT). We observed 673 galaxies with AAOmega and determined redshifts for 398 galaxies. We chose a well defined sample of 132 early-type galaxies from one of the LFC field SDSS 1208+0010 in which we have redshift information for maximum number of galaxies. We derive a range of isophotal shape parameters for sample galaxies that measure their ellipticity and orientation, and also higher order departures from a purely elliptical shape. We then derive mean values for these parameters in four radial bins along the semi major axis of each galaxy. We find empirical fitting formulae for the probability distribution of the different isophotal parameters in each bin, which will be useful for comparison with theoretical studies, e.g. from N-body simulations. We have investigated possible correlations of isophotal shape parameters with other global properties of the galaxies, and inspected whether the correlations change along the radius. Our main finding of the investigation is that the isophotal shapes of the inner regions of our sample of galaxies are statistically different from the isophotal shapes observed in the outer regions. In the central regions we see patterns similar to those seen in previous studies of nearby galaxies, with some galaxies showing 'boxy' isophotes while others appear 'disky'. However, the pattern seen in the inner region of each galaxy tends to change as the radius increases, suggesting that while the inner parts of the galaxies are coherent and presumably the result of specific dynamical processes, at larger radii the shapes and orientations of the isophotes change. This may indicate effects from the formation and evolution of each galaxy which are not yet fully relaxed. We performed a search for LSB galaxies in one of the LFC field m0836 and found 27 LSB galaxy candidates.

ASI2015_475	Sunil Chandra	12.00-12.15

Multi-wavelength Study of Variability in Blazars

Supervisor: Prof. K. S. Baliyan (Physical Research Laboratory, Ahmedabad)

Active Galactic Nuclei (AGNs) are centers of galaxy, very compact in size but emitting huge energy, sometimes more than hundred times the total energy emitted by a normal galaxy. The mechanism of energy generation is understood to be accretion of mater onto a supermassive black hole (10^6 - 10^9 $M_{\odot}$) through accretion disk. Most of them have jets of magnetized plasma moving at relativistic speed perpendicular to the disk. In a sub-class known as blazars, emission is dominated by the non-thermal radiation from the jet, directed at small angles ($\leq 15^{\circ}$) to the line of sight, ranging from radio to γ-rays. However, the exact structure of the jet, its origin, acceleration, collimation and the physical mechanisms behind such huge energy output are not clearly understood. The central energy source is too compact to be resolvable by any present day, and even any new facility in near future. However, the variability in flux and polarization, the defining property of blazars, provides one of the important tools to probe the inner regions of AGNs. In the present work we have used variability in multi-frequency flux and optical polarization for several blazars. Optical photometric and polarimetry obervations for more than seven years carried out from Mt Abu Observatory as well as data at UV, X-ray from Swift and high energy γ-ray from Fermi space observatory are used to explore short and long-term variations and their behaviour at various wavelengths. Shortest time scale variation at a particular wavelength provides information about the size of the emission region. Study of polarization is used to understand the extent of magnetic fields in the emission region. The intra- and inter-night variations in blazar S5 716+714 are used to determine fastest rate of variation and size of the emission region which is very compact ($\sim 10^{15}$ cm). Long term study of the source is used to determine duty cycle of variation which is very high (84 \%). Bluer when brighter nature of flux variations indicates to be shock-in-jet model describing the generation of emission. The work also describes the statistical study on the nature of polarization in blazars and its application in classifying the same. We propose source CGRaBS J0211+1051 to be an LBL based on this and confirm the status by carrying out multiwavelngth study for spectral energy distribution (SED). A detailed study of source PKS 1510-089 using multiwavelength data is made and reasons behind the generation of several outbursts and flares is discussed. The thesis also reports several statistical methods developed/used by me in this study.

ASI2015_698	A. Raghunathan	12.15-12.30

Investigation of Techniques to Detect Cosmological Backgrounds

A.Raghunathan

Epoch of reionzation (EoR) defines a period in the history of universe during which the universe underwent a phase change from neutral to ionized state as a consequence of formation of first stars and galaxies. Hence studying the EoR enhances our scientific understanding of the evolution of the universe. Study could be carried out by probing the state of the neutral hydrogen gas during that epoch. Neutral hydrogen being the most abundant element during that epoch, is expected to undergo spin flip transition at 1420.4 MHz. These transitions are expected to appear as 20 – 30 mK features in the spectrum of the cosmic radio background. Due to the expansion of the universe, the transition frequency gets redshifted by factors 8 – 15 into octave band (87.5 – 175) MHz. Since the universe is assumed to be isotropic and homogeneous, these features ought to be visible in all sky directions. Several pathfinder experiments like the COsmological Reionization Experiment (CORE), Experiment to Detect the Global EoR Signature (EDGES),(BIGHORNS) Broadband Instrument for the Global HydrOgen ReionisatioN Signal have attempted detecting all sky features in red shifted 21cm. All these experiments used single antenna element to measure the power spectrum of the sky background radiation. The power spectrum measured by each one of them was in direct proportion to the noise contributions due to antenna and low-noise amplifier in addition to dominant Galactic and Extragalactic foreground and the EoR signal. Undesired spectral features resembling EoR signal due to the instrumental effects like i) frequency dependent antenna gain ii) frequency dependent LNA noise and iii) impedance mismatch between antenna and LNA. limited the sensitivity of each of them to detect the EoR signal. These limitations in the receiver systems motivated us to develop alternate schemes to overcome them. This thesis describes steps taken to develop instruments and techniques to detect such an all-sky feature. The work includes design and development of specialized purpose built systems for pursuing this goal using both single elements and interferometers. As part of development, i) a new frequency independent fat-dipole antenna was invented to minimize in the output spectrum features arising from the brightness variations over the sky due to antenna gain variation with frequency and ii) Interferometer technique was adopted to reduce the effect of receiver noise in the output spectrum. The inherent insensitivity of the interferometer to uniform sky background was enhanced using a semi-transparent screen in between the two antennas. The system requirements like tolerance to radio frequency interference, dynamic range, linearity were first computed for this science goal; subsequently, the analog receiver chain, calibration noise, and stable frequency reference were designed and built. After signal conditioning, the mutually coherent signal samples in the two arms of the interferometer are multiplied and integrated in a spectro-correlator to produce the power spectrum of the background radiation. A receiver system has been built based on all the stringent design requirement and demonstrated successfully various techniques developed.

ASI2015_526	Mamta Gulati	12.30-12.45

A study of slow modes in Keplerian discs.

Dr. Tarun Deep Saini, Indian Institute of Science, Bangalore and Dr. S. Sridhar, Raman Research Institute, Bangalore.

In this thesis we study slow modes for various astrophysically relevant discs. These modes are suspected to be the reason behind various structures observed in these discs, which inturn are correlated to the global properties of discs. We begin with a study of slow modes in hot, thin accretion discs where the self- gravity is not important. We show that the analysis reduces to a simple Sturm- Liouville type problem and for most physically interesting discs the modes appear to be counter-rotating w.r.t. the Keplerian flow. It is difficult to excite these modes since external forcing is expected to rotate along with the matter in the disc. We then analyze two coplanar counter-rotating discs which interact gravitationally through a softened potential. These discs mimic more complicated stellar discs, where the softening mimics velocity dispersions. We explore slow, azimuthal wave-number m=1, instabilities that make the initial axisymmetric system develop a growing, lopsided, precessing pattern. The problem is addressed both through WKB and integral eigenvalue problem. We next study the dynamics of counter-rotating discs by treating them more realistically as stellar discs in WKB limit. The eigenvalues are obtained for a single disc and equal counter-rotation. The single disc eigen-modes were found to be stable in agreement with the previous calculation by Tremaine; however, the difference is that this treatment is not based on any ad-hoc prescription for disc heat, but uses genuine stellar discs. Another difference is that stellar discs allow slow modes for m values. We discuss and compare the eigenvalues for m=1 and 2 eigenmodes. Then, focusing on non-local short- wavelength modes an integral eigenvalue problem is formulated for a single disc. It is shown using the local analysis that the eigenvalue equation yields the correct dispersion relation, thereby providing a check on the validity of this equation. We then numerically solve the eigen-equation for two disc profiles. We show that due to the symmetry of the kernel of the eigenvalue equation, all slow modes are stable. We also discuss trends in eigen-spectrum and eigen-functions due to variation in the velocity dispersion in the discs, and 'm' values. The modes appear to be qualitatively similar for the two discs analyzed; although the numerical value of pattern speed does depend on the disc profile. We conclude that slow m=1 modes are easier to excite through external perturbation and are thus more likely to be the source of slow time variation in astrophysical discs.

ASI2015_610	Krishna Prasad S.	12.45-13.00

Spectroscopic studies of coronal structures using ground- and space-based data

Thesis Supervisors: D. Banerjee & J. SIngh Affiliation: Indian Institute of Astrophysics

The main energy source for maintaining the solar corona at multi-million kelvin temperatures and the physical mechanism behind the acceleration of fast solar wind are not clearly understood yet. Our knowledge on these issues is advancing with the recent advent of instruments with high spatial, temporal, and spectral resolutions, which at the same time brought many new problems into light. A few such problems motivated the studies presented in this thesis. The possible ambiguity in distinguishing the high speed quasi-periodic upflows from slow magneto-acoustic waves which are observed as propagating disturbances is one interesting issue. This hinders the potential use of these disturbances for seismological applications. The temperature variation along the length of a coronal loop is another unsettled issue which is crucial for determining the plasma heating mechanism. Different imaging and spectroscopic studies were performed in this thesis to improve our understanding on these problems.

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ASI-2015 Poster Presentations

Sun and Solar System

SSS-1	ASI2015_385	M.Syed Ibrahim	Poster

M.Syed Ibrahim and A.Shanmugaraju

Geo-effective solar eruptive events observed during the period 2007-2013

In the present paper, we investigate a set of 118 disc-centered solar eruptive coronal mass ejections (CME) observed during the period 2007-2013. Among the 118 events, 69 events are partial-HALO and remaining 49 events are HALO CMEs. The CMEs details are obtained from the SOHO/LASCO catalog and flare details are obtained from the Hinode catalog. During the period 2007 - 2013, totally 10436 CMEs were observed by the coronagraphs and 710 events are disc-centred events. The events are selected the selection criteria of Manoharan et al. (2004), i.e., the CMEs originated within ±30 degree longitude and latitude. From these 710 CMEs, 118 CMEs are found to be possibly geo-effective.

SSS-2	ASI2015_387	Pramod Kumar	Poster

Rajmal Jain1, Pramod Kumar2, Arun K. Awasthi3, Nipa J. Bhatt4 and Yogesh C. Bhatt2 1Kadi Sarwa Viswavidhalaya, Gandhinagar 392012, India 2Jagan Nath University, Jaipur 303901, India 3Institute of Astronomy, University of Wroclaw, Wroclaw, Poland 4C. U. Shah Science College, Ahmadabad 380014, India

X-ray emission characteristics of a solar flare observed on 05 April 2004

We present temporal and spectral characteristics of X-ray emission from a solar flare observed on 05 April 2004 by the Si detector onboard the Solar X-ray Spectrometer (SOXS) mission. SOXS was flown onboard GSAT-2 Indian spacecraft on 08 May 2003. The flare began at 05:35:30 UT and decayed after 06:30 UT in 4-5 keV energy band. The flare has been observed in 4-20 keV energy range. Temporal characteristics of flare evolution as a function of energy band have been studied in 4-20 keV with the step of 1 keV energy interval. Considering 5?? rise relative to background we find the flare begins first in 4-5 keV but lasts for the longest period than any higher energy band under study. Temporal characteristics suggest that the flare duration in 4-5 keV is longest and keeps on reducing in next higher and higher energy bands. We study in detail the peak time delay as a function of energy interval of 1 keV to investigate the conductive and radiative cooling time scales during the flare. The spectral characteristics are presented of the flare emission in the 4-20 keV energy range. The spectral fits allow us to measure the peak flare temperature, differential emission measure (DEM) and the thermal power-law index employing least-?2 fitting. We carried out forward fit of the count spectra opting CHIANTI code inside the OSPEX and de-convolving over the response matrix. We obtained differential emission measure (DEM) in the range 0.008-0.09 X 1049/cm3 keV; peak flare plasma temperature between 10-20MK and multi-thermal power-law spectral index varying 4.50-7.20. The negative power law spectral index varies between 2.3 and 6.5. The RHESSI mission provides imaging of the flare soft and hard X-ray components and enables us to measure the location and the size of the loops. The half loop length has been estimated to be 30000 km. Key worlds: Solar Flare, X ray emissions, SOXS, Spectral analysis, Spectral parameters

SSS-3	ASI2015_389	G.SELVARANI	Poster

G.Selvarani , A.Shanmugaraju, M.Syed Ibrahim

Multiwavelength analysis of a solar eruptive event occurred on 15th March 2013

In the present work, we studied an intense flare of class M1.1 occurred on 15 March 2013 which has an association with a Coronal Mass Ejection(CME). CMEs are associated with flares, shocks, radio bursts, SEP events, ICMEs and geomagnetic storms. This CME is observed by SOHO/LASCO coronograph and the X-ray flare data are obtained from GOES/HINODE and the SOLAR-B data catalog. From the preliminary analysis, we found that (i) the chosen event is an eruptive one since it has an association with the halo CME of speed 1063km/s and acceleration~ 25.8m/s2 (ii) the onsets of flare and CME coincide with each other around 7:00UT, (iii) a type IV radio burst is reported for this event, (iv) the ICME/IP shock has reached the earth on 17th March 2013 around 06:00UT.

SSS-4	ASI2015_412	Tanmoy Samanta	Poster

Henriques, V. M. J.: Queens University; Banerjee, D. : Indian Institute of Astrophysics; Mathioudakis, M: Queens University

Study of the wave propagation and reflection in the Solar atmosphere using multi-wavelength observations

The trapped acoustic waves (p-modes) inside the Sun can leak from the surface and propagate through the atmosphere if periods are shorter than 3 minutes, known as the acoustic cut-off period, longer periods do not propagate at greater heights in the chromosphere and are, instead, evanescent. But the presence of relatively strong magnetic fields can create magneto-acoustic portals which channel the long-period waves into the upper atmosphere. We have observed a quit Sun region with Swedish 1-meter Solar Telescope (SST) using an Imaging SpectroPolarimeter (CRISP). High resolution, high cadence, line scanning images were taken in different layers from Photosphere to upper Chromosphere. In power maps of the upper photosphere and the lower chromosphere one can identify suppressed power surrounding the magnetic network elements, known as magnetic shadow. Our analysis also shows that the wave with periods above the acoustic cut-off propagate from the photosphere to upper layers only in restricted areas in presence of magnetic filed. This supports recent results arguing that network magnetic elements can channel low-frequency photospheric oscillations into the chromosphere, thus providing a way to input mechanical energy in the upper layers. We conclude that the magnetic shadow is linked to the wave mode conversion process which depend on magnetic field topology at the region.

SSS-5	ASI2015_423	Hariharan Krishnan	Poster

Ramesh R.(1), Kishore P.(1), Kathiravan C.(1) and Gopalswamy N.(2) (1) Indian Institute of Astrophysics (2) Solar Physics Laboratory NASA/GSFC

AN ESTIMATE OF THE CORONAL MAGNETIC FIELD NEAR A SOLAR CORONAL MASS EJECTION FROM LOW-FREQUENCY RADIO OBSERVATIONS

The Indian Institute of Astrophysics presently operates three different instruments, a radio heliograph (GRAPH), a low frequency radio spectrograph (GLOSS) and a radio polarimeter (GRIP) at the Gauribidanur radio observatory about 100 km north of Bangalore. All the above instruments are deidicated for solar observations and operate in the frequency range 120 – 40 MHz which corresponds to a heliocentric distance range of 1.2 – 1.8 R 0 in the solar atmosphere. The above is presently inaccessible to other regions of the electromagnetic spectum due to practical difficulties. We report observations, obtained with the above instruments, of a type II solar radio burst associated with a solar coronal mass ejection (CME) that occurred on 2013, May, 02. The burst was associated with a 1N class Hα flare and M1.1 class GOES soft X-ray flare from AR 11731 located at the heliograghic coordinates N10W25. The spectral observations indicate that the burst has fundamental (F) and harmonic (H) emission components with split-band and herringbone structures. The imaging observations at 80 MHz indicate that the H component of the burst was located close to the leading edge (LE) of the CME. Using the polarimeter observations of the type II burst, also at 80 MHz, the magnetic field in the coronal region ahead of and behind the associated MHD shock front were estimated to be ~ 0.7-1.4 +/- 0.2 G and ~ 1.4-2.8 +/- 0.1 G, respectively. Routine measurements of the magnetic field strength in the solar atmosphere are presently limited to the photospheric and chromospheric layers of the sun. The coronal magnetic field is estimated from such measurements using extrapolation techniques. Also estimates of magnetic field close to the LE of a CME are rarely reported. Given the paucity of coronal magnetic field measurements at present, particularly in close temporal and spatial association with a CME, our results provide useful constraints on the magnetic field strength involved in shock acceleration theories.

SSS-6	ASI2015_442	Prithvi Raj Singh	Poster

B.K.TIWARI,A.K.SAXENA PRITHVI RAJ SINGH*

Variation of odd-even solar cycle's and their effect on earth's climate

Variation of odd-even solar cycle's and their effect on earth's climate PRITHVI RAJ SINGH, A.K.SAXENA, B.K.TIWARI Department of Physics A.P.S.University, Rewa, M.P.-486003(INDIA) E-mail: prithvisingh77@gmail.com Abstract To Study of influence of solar activity during solar cycle 21-24 on climate change specifically the change in the global mean temperature might have been associated with the variation of some solar activity indices .The important indices are total solar irradiance (TSI),Ultraviolet(UV)radiance and radio flux have been presented. The re construction of solar irradiance in the past period before accurate measurements of solar irradiance, ultraviolet radiance and radio flux. The study the sun climate relationship by averaging solar cycle21-24 and climate date at various time scales .the term global warming is now popularly used to refer the recent increases in the mean surface temperature of earth .the sun can have obvious effect on climate change and its radiation is the main energy source for the outer envelops of our planet. The climate changes are interested in understanding the effect of variation in the total and spectral solar irradiance on earth and its climate. Variation in total solar irradiance were too small to detect with technology available before the satellite although the small fraction in ultra-violet light has recently been found to vary significantly more than previously thought over the solar cycle 21-24.UV irradiance increase causes higher ozone production, leading to stratospheric heating and to pole ward displacements in the stratospheric and tropospheric wind systems. The most likely mechanism is considered to be some combination of direct forcing by change in total solar irradiance, and indirect effects of ultraviolet (UV) radiation the stratosphere. The solar particle streaming around the Earth's magnetosphere using the long –lasting measurements and taking into account variable orbital parameters of the spacecraft. The distribution of the upstream particles was found to depend strongly on the solar cycle.

SSS-7	ASI2015_445	Rakesh Mazumder	Poster

Vaibhav Pant Dipankar Banerjee Indian Institute of Astrophysics

Signature of oscillation in Solar on disk Plume using IRIS

The cause of coronal heating and solar wind acceleration remains a highly debated and interesting problem in solar physics for decades. Here we have seen oscillation in a solar on disk plume structure near coronal hole with high spatial and spectral resolution of IRIS. There are several reports of oscillatory signature in plume region from SDO/AIA data. We have analysed 1 hour 24 minutes sit and stare data taken with 5 second raster cadence and 5.1 second step cadence by IRIS. The data is taken on 2014-07-12 from 16:27:08-17:51:29 UT. We have done spectroscopy with far-UV line Si IV. IRIS has 40 mA spectral resolution in far UV line. With this high resolution we have seen in dopplerogram clear signature of oscillatory motion.

SSS-8	ASI2015_469	Dada Pandurang Nade	Poster

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Influence of the Milky Way Galaxy on nightglow OI 630 nm emission

This paper investigates the intensity aspects of nightglow OI 630.0 nm emission obtained from all sky imager (ASI) at low latitude station N dip lat.), India. Herein we have°E, and 10.6°N, 74.2°Kolhapur (16.42 taken average intensity of cropped images (5 × 5 pixel size) of OI 630.0 nm, to study the nocturnal variations in intensity. The results show that when Milky Way Galaxy presents then the major enhancement occurred in intensity. The reason for this behavior may be associated with action of high energetic radiation from galaxy. However post-midnight enhancement in intensity of OI 630.0 nm emissions as result of the midnight temperature maximum (MTM) phenomenon, as anomalous behavior of neutral temperature during night in the F region has been reported from Indian and Brazilian sector by several investigators. An enhancement in intensity is important source of intermittence due the presence of the galaxy in the sky on observation nights. This work will help to develop the new theory related to ionosphere and extra terrestrial objects. Supporting data is necessary to find out possible mechanism for such events. Keyword: Ionosphere, extra terrestrial, galaxy *Corresponding author Email: aks_phy@unishivaji.ac.in (A. K. Sharma)

SSS-9	ASI2015_497	Ajanta Datta	Poster

V.Pant, Indian Institute of Astrphysics, Bangalore. D. Banerjee, Indian Institute of Astrphysics, Bangalore.

High Frequency Dynamics of Braided Coronal Magnetic Structures as seen from Hi-c

The understanding of the heating mechanism/s of the solar corona is one of the main challenges in solar physics. Two types of mechanisms are well accepted, namely impulsive heating by nanoflares and wave heating by dissipation of waves. High frequency waves may play a significant role in coronal heating. In spite of early prediction of existence of high frequency intensity oscillations, unavailability of observation with high time resolution hindered their detection. The recent Hi-C rocket experiment has unprecedented spatial resolution (3-4") and a cadence of 5.5s. These observations have revealed many new features of the corona. Cirtain et.al. have shown the first evidences of magnetic field braiding and axial twist from Hi-c Observation. In this paper we have studied high frequency dynamics of braided coronal structure. We have shown enhanced intricate coronal structures, using some processing techniques involving Fourier power map, which are not visible even with the high quality image from Hi-C. Propagating disturbances of periodicities 30 sec to 70 sec are detected near the braided region. The disturbances are of longitudinal and transverse in nature. The bursty nature of these disturbances might be the evidence of multiple reconnection in that region.

SSS-10	ASI2015_531	Tomin K James	Poster

Prasad Subramanian, IISER Pune

Energy Budget in Quiet Sun Electron Accleration Events

The power involved in elemental electron acceleration events in the solar corona is of considerable interest in the context of coronal heating. We focus on electron acceleration events that occur during relatively quiet periods, excluding large transients such as flares or coronal mass ejections. We build a database of such events observed by near-Earth spacecraft such as ACE, WIND and STEREO and shortlist only those which can plausibly be linked to acceleration episodes in the solar corona. The electrons detected at the Earth during such episodes presumably represent a fraction of the population that was accelerated in the corona. By calculating the power carried by the energetic electron population observed at the Earth, we hope to obtain an estimate of the power involved in the coronal acceleration episode. Such an estimate directly yields the energy contained in the accelerated electrons, without an appeal to the radiation generated by them or subsequent plasma heating.

SSS-11	ASI2015_566	Gurpreet Kaur	Poster

G. K. Bhatia and S. Sahijpal, Department of Physics, Panjab University, Chandigarh,India (sandeep@pu.ac.in)

DIFFERENTIATION OF MARS DUE TO RADIOGENIC AND IMPACT HEATING

Introduction: Mars is a planetary embryo that escaped further planetary accretion to form Earth sized big planet. 182Hf-182W isotopic systematic of SNC meteorites suggest an early and rapid accretion of Mars in the initial few million years (Ma) during the formation of solar system. The early and rapid accretion of Mars supports the role of heat produced by decay of short lived radio nuclides 26Al and 60Fe. In the earlier works, only the effect of heat produced due to impacts on the surface of accreting Mars was considered which resulted in the formation of a metallic shell instead of an iron core. In the present work, we have numerically simulated the early thermal evolution and differentiation of Mars upto initial (25 Ma by considering the effect of heat produced due to decay of 26Al and 60Fe along with heat of impacts on the surface of accreting Mars into an iron core and silicate mantle. Methodology: Partial differentiation equation of heat transfer is solved using finite difference method by incorporating the heat produced due to the decay of 26Al and 60Fe along with impacts. We ran various simulations by considering four important parameters that include onset time of accretion of Mars after the formation of CAIs, accretion duration, initial abundance of 60Fe due to uncertainty in its value and the melt percolation velocity of metallic blobs through silicate melt to form an iron core. Since Mars is a comparatively bigger body as compared to planetesimals and asteroids, the interior of Mars is having very high pressure due to which the melting temperature of iron and silicate will increase. We have modified the melting temperature of iron and silicate in our model based on its dependence on pressure. Upon 40% partial melting of silicate, metallic blobs were moved towards the center of Mars to form an iron core and silicate mantle (CM model). We also ran one simulation to study the core-mantle-crust (CMC model) differentiation of Mars in which upon 20% partial melting of silicate, 26Al-rich basaltic melt was extruded upwards. We ran a set of four simulations to study the dependence of rate of differentiation of Mars on percolation velocity of metallic blobs. Results and Discussion: Results show that the onset of accretion of Mars should commence in the initial 1.5 Ma for early differentiation of Mars. A further delay in the onset of accretion would result in prolonged differentiation or even no segregation. However, an increase in the initial abundance of 60Fe/56Fe results in the differentiation of Mars into iron core and silicate mantle. The melt percolation velocity less than (0.1 m yr.-1 reduces the possibility of even planetary scale differentiation of Mars. An early accretion of Mars results in the large scale planetary differentiation of Mars. This seems to be consistent with the records of the Martian meteorites.

SSS-12	ASI2015_594	Dr. K. CHENNA REDDY	Poster

G Yellaiah

Meteoroid fragmentation as observed from the Gadanki MST radar

The phenomenon of meteoroid fragmentation in the Earth's atmosphere is of considerable importance in understanding the dynamics of the upper atmosphere. The radar meteor light curve is defined as the pulse-integrated Signal to Noise Ratio (SNR) as a function of time, which is analogous to the light curve of optical meteors, which is an indicative of ablation processes during meteoroid flights in the atmosphere. Meteor light curves also have been used to understand the physical structure and chemical composition of meteoroid. In this study, we present and discuss few examples of pulsating meteor light curves from the observations made with the 53 MHz MST radar system. These light curves reveal many previously unreported features in the radar meteor return that are consistent with meteoroid fragmentation. Some of them provide the strong observational evidence of a sub-millimeter-sized meteoroid breaking apart into two distinct fragments. The pulsations in light curves are interpreted as being due to interference from two distinct scattering centers and the detected pulsation rates are utilized to calculate the differential velocity of the fragments. The results are in consistent with interference from two fragments of unequal cross-sectional area over mass ratio, separating from each other due to different deceleration along the trajectory of their parent meteoroid. Some other meteor events are examples of a meteoroid undergoing quasi-continuous disintegration.

SSS-13	ASI2015_595	Rohit Sharms	Poster

Rohit Sharma, Divya Oberoi and the MWA Collaboration

Characterising non-thermal emission features in the MWA solar dynamic spectra.

The Murchison Widefield Array (MWA) is a low radio frequency (80-300 MHz) SKA path-finder located at the site chosen for the SKA Western Australia. The Sun is known to be quite dynamic at these frequencies with emissions from mechanisms spanning a wide range of brightness temperatures. The MWA observations have further revealed the presence of short-lived, narrow-band weak emission features in the solar dynamic spectra even during relatively quiet solar periods. These time and frequency varying non-thermal emissions are superposed on the relatively steady and spectrally smooth blackbody emission from the million K corona, which forms the bulk of the solar emission at these frequencies. We have initiated a project to build quantitative estimates for the presence of these non-thermal features across the MWA observing band. We characterise these emissions by modelling the intensity distributions observed in the dynamic spectra using a Gaussian mixture approach and attempt to distinguish between the thermal and non-thermal emission components. This talk will present the initial results and the future plans for this effort.

SSS-14	ASI2015_597	Priya T G	Poster

J.T.Su, Y.Liu, Y.D.Shen

Increase in amplitude of QPDs with height in the polar corona

The observations taken from the polar region of the corona with the Atmospheric Imaging Assembly (AIA) onboard the SDO are investigated for amplitude of quasi periodic disturbances that increases with height in the lower corona. Pressure scale height, period and wavelength in AIA 171 A, 193 A and 211 A channels are determined statistically. The acoustic velocities obtained from the scale height correlates with the phase speeds which provides an evidence for SMW's.

SSS-15	ASI2015_609	Krishna Kumar Pandey	Poster

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Cyclic evolution and north-south asymmetry of soft X-ray flare index during solar cycles 21, 22, and 23

In this paper, we present a comprehensive statistical study to investigate the temporal and spatial distribution of solar flare activity during solar cycles 21, 22, and 23. We characterize the flare activity within a time interval by soft X-ray flare index (FI) rather than traditional flare counts. In general, FI shows a good correlation with other parameters of solar activity. We find that FI correlates much better with sunspot area than sunspot number. The study reveals a significant north–south asymmetry of FI which exhibits variations with the phases of solar cycle. The significance of north-south asymmetry is assessed by student’s t-test. We find that the reliability and persistency of asymmetry significantly increases when the data is averaged over longer periods while an optimum level is achieved when data is binned for ~11-12 Carrington rotations. The observed shift in asymmetry of FI from one hemisphere to the other near the maximum phase of solar cycle is in agreement with previous studies carried out with other solar activity indices. The time profile of FI suggests a dual-peaked structure of solar cycle which is the most prominent during solar cycle 22.

SSS-16	ASI2015_649	Gangadhar Chavan	Poster

Effect of Magnetic Activity on Ionospheric Irregularity G. A. Chavan1, A. K. Sharma*1, S. S. Nikte1,3, D. P. Nade1,2 , R. N. Ghodpage4,P. T. Patil4, M. A. Yewale1, O. B. Gurav1 1Earth and Space Science Laboratory, Department of Physics, Shivaji University, Kolhapur, India 2Department of Basic Sciences and Humanities, Sanjay Ghodawat Group of Institutions (SGI), Atigre, India 3Department of Basic Sciences and Humanities, Vishveshwarya Technical Campus Patgaon-Miraj, India 4Medium Frequency Radar, Indian Institute of Geomagnetism, Shivaji University Campus, Kolhapur, India

Effect of Magnetic Activity on Ionospheric Irregularity

The amplitude scintillation data of 251MHz signal recorded by two spaced receivers at low latitude station Kolhapur [16.420N, 74.20E] is used. In this paper we have considered the magnetically disturbed days (Ap>20) to investigate the effect of magnetic activity on the generation of ionospheric irregularities. Random velocity of the irregularity which is a measure of random changes in irregularity drift velocity is evaluated. Decrease in the value of random velocity to its lowest value by 23 LT may be due to decrease in the height of F region. Maximum cross-correlation CI(x0,tm) between the two signals recorded by two spaced receivers shows the decreasing pattern which attributes the fresh generation of irregularities. Keyword: Ionospheric irregularity, Magnetic Activity,Cross-correlation *Corresponding author Email: aks_phy@unishivaji.ac.in (A. K. Sharma)

SSS-17	ASI2015_690	Dr. Bimal Pande	Poster

Bimal Pande(1), Seema Pande(2), Hema Bisht(2) &Ramesh Chandra(1) 1. Physics Department DSB Campus, Kumaun University, Nainital 2. MB Govt. P.G. College Haldwani

GEOEFFECTIVENESS OF SOLAR ERUPTIONS DURING THE RISING PHASE OF SOLAR CYCLE 24

In the present paper we have studied the different statistical parameters responsible for the geoeffectiveness of the solar eruptions such as CME source locations on the solar surface, speed, width and flare association. We have taken a set of 191 halo coronal mass ejections (CMEs) of rising phase of cycle 24(Oct 2008-Dec 2013). Minimum Dst values occurring within 1-5 days after the CME onset were observed. We grouped the levels of geomagnetic activity into two groups on the basis -100) and≥ Dst≥of observed minimum Dst index i.e., first moderate (-50 -100). We studied the correlation between Dst≥second intense (Dst indexes, CME speed and flare class. A low geomagnetic activity in the rising phase of solar cycle 24 is observed. During the given period, most of the events were dominated in the northern hemisphere. This shows the north-south asymmetry in the source region of geoeffective events. We also observed that most of the geoeffective events are either from central location or from western hemisphere, which confirms the earlier findings.

SSS-18	ASI2015_717	Suraj	Poster

S. S. Nikte1,2, A. K. Sharma1*, D. P. Nade1,3 , G. A. Chavan1,O. B. Gurav1 , M. P. Yadav2, P. T. Patil4, R. N. Ghodpage4, M. V. Rokade5 and R. V. Bhonsle1 1Earth and Space Science Laboratory, Department of Physics, Shivaji University, Kolhapur, India 2Department of Basic Sciences and Humanities, Vishveshwarya Technical Campus Patgaon-Miraj, India 3Department of Basic Sciences and Humanities, Sanjay Ghodawat Group of Institutions (SGI), Atigre, India 4Medium Frequency Radar, Indian Institute of Geomagnetism, Shivaji University Campus, Kolhapur, India 5Centre for Materials for Electronics Technology (C-MET) Hyderabad, 500051

Study of signal strength of cosmic radio noise using riometers

In this paper we have studied latitudinal and longitudinal variations in the signal strength of cosmic radio noise for both the hemispheres. The quiet-time ($\Sigma Kp \leq 3$) daily variations of the cosmic radio noise at Polar, auroral, subauroral and mid-latitude stations during period of solar minimum are utilized to develop the quiet day pattern of cosmic noise signals with corrected geomagnetic latitude and longitude. Data of three southern and seven northern riometer stations have been used in the present study. Riometers at different locations will observe a different part of the sky noise and that is the reason that QDCs are produced for each individual riometer. Average of five international quiet days is done to execute a signal pattern for a particular month. For polar latitudinal stations Davis and Mason (Geomag lat.73.05˚S, Geomag Long. 111.67˚E), it is observed that there is a change in the maximum value of the signal strength. We observed shift of quiet day pattern in each month is due to the sidereal day. Keywords: Riometer, Quiet Day Curve, Ionospheric absorption

SSS-19	ASI2015_719	Supriya Hebbur Dayananda	Poster

H. N. Smitha^{1}, K. N. Nagendra^{1}, J. O. Stenflo^{2,3}, M. Bianda^{3}, R. Ramelli^{3}, B. Ravindra^{1}, and L. S. Anusha^{4} 1. Indian Institute of Astrophysics, Bangalore 560034, India 2. Institute of Astronomy, ETH Zurich, CH-8093 Zurich, Switzerland 3. Istituto Ricerche Solari Locarno, Via Patocchi, CH-6605 Locarno-Monti, Switzerland 4. Max Planck Institut f\"ur Sonnesystemforschung, Justus-von-Liebig-Weg 3, D-37077 G\"ottingen, Germany

1-D modeling of the Center-to-limb variation of the Stokes profiles of the Ca I 4227 A line

The observed center to limb variation (CLV) of different lines in the linearly polarized spectrum of the Sun i.e., the Second Solar Spectrum (SSS) can be used to sample the height dependence of various atmospheric quantities like the magnetic fields via the Hanle effect. This is because the observations made at different lines of sight sample different heights in the solar atmosphere. We have attempted to simultaneously model the CLV of the observed Stokes (I, Q/I) profiles of the Ca I 4227 A line. For purpose of modelling we used various 1-D solar model atmospheres. We found that all the standard model atmospheres attempted by us and also an appropriate combination of them fail to simultaneously fit the CLV of the observed Stokes (I, Q/I) profiles. The details of our modeling efforts and the results will be presented.

SSS-20	ASI2015_721	Girjesh R. Gupta	Poster

Durgesh Tripathi IUCAA, Pune

Alfv\'en wave/turbulence in the off-limb solar corona

There are several models which explain the role of Alfv\'en wave/turbulence in the heating of solar corona and acceleration of the solar wind. Model predicts the different velocity amplitude in different solar structures depending on their area divergence and density drop rates with height. Alfv\'en wave/turbulence velocity amplitude can be measured from the non-thermal component of the spectral line profile. We obtained Alfv\'en wave/turbulence velocity amplitude in the active region and quiet Sun region with height using several highly ionized Fe spectral lines (Fe XII 195.12 \AA\ and 196.64 \AA\, and Fe XIII 196.54 \AA\ and 202.04 \AA). Measured velocity amplitude in the active region first increases with height and later decreases further out following the trend as per the model predictions whereas that in quiet Sun region drops continuously with height which was unexpected and requires careful analysis of involved processes. Line ratio methods where used to obtain the density and temperature of the observed region. Measured quantities will be used to infer whether the observed wave/turbulence is either undamped or getting damped with height. Effect of temperature, abundance, charge/mass, kappa distribution etc will also be discussed on the measured quantities.

SSS-21	ASI2015_726	Ms. Kunjal Maheshkumar Dave	Poster

Kunjal Dave1, Miral Bhatt1, R. M. Jadhav2 1 Research Scholar, C. U. Shah University, Wadhwan, Surendranagar-363030, Gujarat 2 Assistant Professor, Gujarat College of Arts and Science College, Ahmedabad-380006

Statistical Study of Space Weather Events with Geomagnetic Storm in Various Phases of Solar Cycle

In recent decades, effects of solar storms like solar flare, coronal mass ejection (CME), solar bursts etc. have been found to have major effects on terrestrial magnetic field. The earth’s magnetosphere such as geomagnetic storms has important effects on technological society. Comparison between solar events occurred at different phases of solar cycle is done to understand solar terrestrial relations. Various spacecraft data for solar events, interplanetary medium are used and ground based magnetic field measurements were used to correlate. Some conclusions from the study will be presented here.

SSS-22	ASI2015_739	Miral Bhatt	Poster

Miral Bhatt1, Kunjal Dave1 and R. M. Jadhav2 1Research Scholar, C. U. Shah University, Wadhwan, Surendranagar - 363030, Gujarat. 2Assistant Professor, Gujarat College of Arts and Science College, Ahmedabad-380006.

Study of Geoeffective Storms and its Solar Connections using Spacecraft data

Study of geoeffective storms and its association with various parameters of a Coronal Mass Ejections like Coronagraph image, height-time plot etc. and Dst index has been done. By analyzing many more various parameters like sunspot numbers, solar wind speed, plot graph of Dst index versus sunspot numbers etc, we have tried to deduce statistical inference about solar – terrestrial relations. The study had been done for Solar cycles 22, 23 and 24. We have considered the effects of halo CME on earth's atmosphere as well as on magnetosphere. An attempt is made here to understand how halo CME affect earth's communication system.

SSS-23	ASI2015_743	Akshay S	Poster

Akshay S. (1), Divya Oberoi (2), Brian Timar (3), Victor Pankratius (4), Colin Lonsdale(4) 1 - IISER Pune, India 2 - NCRA-TIFR, Pune, India 3 - UC Berkeley, CA, USA 4 - MIT Haystack Observatory, MA, USA

Automated characterisation of weak solar bursts in the MWA data

The newly commissioned Murchison Widefield Array (MWA) has revealed the presence of a numerous weak and short lived low frequency radio solar bursts. These emission features have duration of order a second, have relatively narrow spectral widths and are surprisingly numerous even during quiet solar conditions. Their appearance in the time-frequency plane is unlike that of the any of the known classes of radio bursts, and they are at least an order of magnitude weaker than the weakest type III bursts routinely monitored and reported (e.g. by Automated Radio Burst Identification System operational at the Learmonth Radioheliograph in Australia). A systematic and detailed characterization of the statistical properties of these bursts is the first logical step to build an understanding of these bursts. However, the MWA data are quite voluminous (~1 TB/hour) and apart from being computing intensive, interferometric analysis is usually also very human effort intensive. To alleviate this situation, we have developed a novel system using wavelet decompositions, and thresholding techniques for event recognition and parameter extraction in an automated manner. Here we present the statistical properties of these weak radio bursts based on a large number of events, as detected and characterised by these automated methods.

SSS-24	ASI2015_758	Madhusudan Ingale	Poster

Dr. Prasad Subramanian Associate Professor, IISER, Pune

Amplitude of Density Turbulence in the Solar Corona

The amplitude of density turbulence (C_N^2) is key in determining the scattering properties of the solar wind and the solar corona. This subject is crucial to a full understanding of the nature of MHD turbulence in the solar corona. Also C_N^2 is an important quantity to determine the modulation index ϵ, which is of vital importance in understanding several problems in solar wind turbulence.\\ We have obtained C_N^2 as a linear fit to the bservations of the phase structure function between 2 to 16 $R_{\odot}$. This C_N^2 is used to obtain ϵ for the scales of density irregularities between 50 km to 1000 km. We find that the amplitude of density turbulence in the inner corona is much higher than that predicted by the earlier empirical model. Modulation index is found to be increasing initially but may satuarates to $\epsilon = 0.03$ for $R > 30 R_{\odot}$.

SSS-25	ASI2015_762	Kumar Venkataramani	Poster

Kumar Venkataramani(PRL), Shashikiran Ganesh(PRL), Sonam Arora(CSSTEAP/PRL) K S Baliyan(PRL) Navpreet Kaur(PRL)

The Comet C/2013A1(Siding Spring) and Mars

Observations of Comet C/2013 A1 (Siding Spring), were carried out in B,V and R broad band filters and narrow band(Hale-Bopp comet filter set) with the 1.2m telescope at the Gurushikar Observatory, Mount Abu. This comet had a close encounter with Mars on 19th of October 2014. The comet was monitored in the first week of October, then during the close flyby from 17th October to 22nd October and during the first week of November 2014. Imaging, spectroscopy and polarimetry were carried out at different epochs. The comet was at perihelion on 25th October. Post-perihelion brightening has been observed for this comet. We also imaged the comet continuously in the above period with a 50cm telescope in the R band. Further observations of this comet are planned when it comes out of conjunction with the Sun (late January 2015). In this paper, we shall summarize the results from these observations.

SSS-26	ASI2015_787	Pallab jyoti Kakoti	Poster

Pallabjyoti Kakoti (Gauhati University), Dr. Eeshankur Saikia (Gauhati University),

Simulation of Hydrodynamical Model using NIRVANA

3-Dimensional Magnetohydrodynamics Numerical Simulation is carried out for a turbulent, compressible stellar environment varying various control parameters. The interaction between convective plumes and magnetic flux observed from scaling laws confirms strong correlation between magnetic field and convection as either of the two gets strengthened. As the energy exchange between convective core and radiative envelope needs more efficient handling of the available formalism.

SSS-27	ASI2015_819	Bhupendra Kumar Tiwari	Poster

B.K.Tiwari

Impact of Solar Variability on the Helioshphere and Cosmic Ray Modulation

Impact of Solar Variability on the Helioshphere and Cosmic Ray Modulation B.K.Tiwari and D.P.Tiwari Department of Physics A.P.S.University Rewa (M.P) Abstract- Modulation in the cosmic ray intensity (long-term and short-term basis) produces due to the structure of the heliosphere, controls by solar outputs and their variability. Based on the observation from Omniweb data for solar- interplanetary parameters and monthly mean count rate of cosmic ray intensityonthly mean count rate of cosmic ray intensity (CRI) variation data from neutron monitors were used during 1996-2014. It is observed that during declining phase of solar cycle 23and ascending phase of 24 solar cycle , the sun is remarkably quiet and the strength of the interplanetary magnetic field has been falling off to new low levels , (the mean value of the IMF was recorded between 2007-2009 as compared with 1985-1987 and in 1995-1997), reduces the GCR entering inner- heliosphere and it is high anti-correlation has been found between sunspot number & GCR flux. It is also found that count rate of cosmic ray intensity and solar- interplanetary parameters were inverse correlated and these solar indices were positive correlated. Keywords- Cosmic ray intensity (CRI), Sunspot number (SSN), Solar activ

SSS-28	ASI2015_837	INDUJA M S	Poster

P. K. Manoharan Radio Astronomy Centre NCRA-TIFR Ooty

Steadily Declining Activity During Solar Cycles 22-24 and its Consequences on the Propagation of Coronal Mass Ejections in the Inner Heliosphere.

The activity of the current solar cycle in its maximum phase is low compared to the corresponding maxima of cycles 22 and 23. Interplanetary scintillation (IPS) observations made with the Ooty Radio Telescope at 326.5 MHz reveal a steady decline of solarwind speed and density turbulence between cycles 22 to 24. In this study, in association with the above steady decline of activity, we consider initiation and propagation characteristics of coronal mass ejections (CMEs). We analyse ~30 CME events at three representative phases of solar cycles 22 to 24. The near sun dynamics of these events have been obtained from white-light images. In the midway between sun and earth, the size and speed of CMEs have been estimated from Ooty IPS measurements. This study discusses the rate of expansion/propagation of the CMEs as a function of solar cycle.

SSS-29	ASI2015_840	Sangeetha C R	Poster

Rajaguru S.P. Indian Institute of Astrophysics

Hemispherical dependence of solar small-scale kinetic and magnetic helicities

The magnetic helicity of small-scale fields on the Sun shows an opposite hemispherical pattern (in sign) than that of the large-scale magnetic fields (containing sunspots). Here, using Doppler and magnetic data from the Helioseismic and Magnetic Imager (HMI) onboard the Solar Dynamics Observatory (SDO), we examine if the above pattern is caused by fluid motion around magnetic structures - we derive horizontal velicities estimated through local correlation tracking. We derive kinetic helicity of fluid motion and study its connection to the small-scale magnetic helicity.

SSS-30	ASI2015_853	Vaibhav Pant	Poster

Patrick Antolin, National Astronomical Observatory Of Japan, Sudip Mandal, Dipankar Banerjee, Indian Institute Of Astrophysics

Transverse Oscillations In Coronal Rain

Coronal Rain Is The Plasma Condensations Which Fall, With Velocity Less Than Free Fall, To Chromosphere Along The Loop Like Paths. They Are Normally Associated With Active Region Loops. They Consists Of Cool Plasma And Are Produced In Solar Atmosphere In Few Minutes. They Are Believed To Be Formed In Coronal Loops Because Of Thermal Instability. We Report The Transverse Oscillations In Coronal Rain As Observed By Iris. Such Oscillations Are Also Reported Before Using Sst In H-Alpha. In Iris We Can Investigate The Properties Of Coronal Rain At Transition Region And Seismologic Parameters Can Be Derived Which Can Give An Estimate Of Magnetic Fields And Alfven Speed In Such Structures. Such Oscillations Are Also Seen In Aia 304 Images And Thus Combining Iris And Aia 304 We Can Investigate The Properties Of Coronal Rain With Different Heights Above The Sun Surface. In This Work We Report Transverse Oscillations As Observed In Iris And Aia 304, We Estimate Seismologic Parameters And Other Properties Of Coronal Rain.

SSS-31	ASI2015_865	P Sreekumar	Poster

Subramania Athiray, Thesis supervisor- Dr. P. Sreekumar

Study of lunar surface chemistry using Swept Charge Devices

The surface of the Moon is of prime scientific importance as it is very ancient and preserves record of early geological history of the solar system. The lunar surface has been explored extensively at multi-wavelengths through space-based experiments. This thesis deals with understanding the chemical composition of the lunar surface using x-rays. Since the Apollo era, there have been very a few successful observations of the x-ray studies of the lunar surface. The Chandrayaan-1 X-ray Spectrometer (C1XS) onboard Chandrayaan-1 was designed to map the abundances of major rock-forming elements viz., Mg, Al, Si, Ca, Ti and Fe on the lunar surface using the X-ray fluorescence (XRF) technique. In this thesis, we present a comprehensive summary of entire C1XS observations. The first direct spectral evidence of sodium (Na) along with other rock-forming elements from the Moon, as observed by C1XS is demonstrated. A detailed description on the spectral analysis of C1XS data is presented from where XRF line fluxes of major rock-forming elements are derived. An independent XRF inversion algorithm {\it x2abundance} is developed to convert the observed XRF line fluxes to elemental abundances. Algorithm and validation of {\it x2abundance} using laboratory XRF experiments, with metal alloys and lunar analogue rocks are presented. Lunar surface elemental abundances are determined for the C1XS-observed regions using the inversion algorithm. A summary of major findings from the C1XS experiment along with the scientific importance of the discovery of Na on the lunar surface are presented. Due to lack of solar x-ray activity and limited mission life-time, C1XS could not achieve global elemental mapping. Chandrayaan-2 Large Area Soft x-ray Spectrometer (CLASS) is being developed for Chandrayaan-2 to answer the questions raised by C1XS results and complete global mapping with enhanced sensitivity using new generation SCDs (CCD-236). A detailed physical model is developed to simulate x-ray photon interaction in SCDs. This Monte Carlo simulation aims at modeling device level interactions to better understand the spectral redistribution function of SCDs. Algorithm of the model, implementation and comparison with C1XS ground calibration data are presented. At the end, list of science cases for future lunar surface studies are presented. Further, to carry out better scientific investigations in future, a few design aspects which can potentially improve the surface exploration of the Moon/airless planetary bodies in xrays are also presented.

SSS-32	ASI2015_875	Manashee Adhikary	Poster

Eeshankur Saikia, Gauhati University

Quantification of Correlation between the Solar Activity during Solar Cycle and the Terrestrial Environment through Wavelet Transformation

Quantification of Correlation between the Solar Activity during Solar Cycle and the Terrestrial Environment through Wavelet Transformation The impact of solar wind on the terrestrial environment requires appropriate tools in order to bring forth the apparently hidden correlation. Although several researches have suggested existence of very long term correlation between the highly non-linear solar activities and near Earth space data, we have determined appropriate set of parameters to quantify the correlation in a more holistic yet easier way. Using wavelet transform analysis, an attempt is made to visualize the effect of solar variability on the climate parameters over the entire solar cycle. The analysis undertaken throughout the cycle not only shows presence of unstable periodic orbits, but also suggests the possibility of use of other tools of Non-linear Dynamical Theory in calibrating the interaction.

SSS-33	ASI2015_876	Seema Pande	Poster

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Statistical study of different solar activity features with total column ozone at two hill stations of Uttarakhand

This paper presents a statistical study of different solar activity features (DSAF), viz. sunspot number (SN), solar active prominences (SAP), solar flares (SF) and solar proton events (SPEs) with total column ozone (TCO) amount using 28 years (1986-2013) data. The ozone data has been taken for two hill stations of Uttarakhand, i.e. Nainital (29º23'N, 79º27'E) and Mussoorie (30°27'N, 78°06'E). The study reveals a positive correlation between yearly averaged TCO and DSAF. The value of linear correlation coefficient (r) for TCO-Nainital with SN, SAP, SF and SPEs is found to be 0.51, 0.30, 0.49, and 0.54, respectively and for TCO-Mussoorie with SN, SAP, SF, SPEs is found to be 0.45, 0.27, 0.44, and 0.51. This supports the fact that solar activity features contribute to the production of ozone. Also the trend in TCO over both the stations annually, monthly and seasonally has been studied. A negative trend is observed indicating a decrease in the ozone concentration over these stations in given time period.

SSS-34	ASI2015_884	Sankalp Gilda	Poster

Dr. S.P. Rajaguru Indian Institute of Astrophysics, Bangalore

THEORETICAL ESTIMATES OF ACOUSTIC WAVE TRAVEL-TIME SIGNATURES DUE TO DEEP DOUBLE-CELL MERIDIONAL FLOWS IN THE SUN

In view of the recent claims about the existence of a second meridional cell, stacked radially below the first one, we have carried out theoretical calculations to get independent confirmation of the results. Specifically, we have referred to \emph{Zhao et al. (2013)}, where the authors have used two years of helioseismic data from HMI to analyze travel times of acoustic waves propagating through different depths in the solar interior, and concluded that a two-cell meridional circulation profile with a poleward flow below 0.82${R_\odot}$ would still give time differences comparable to those from other independent measurements, thus suggesting a rethinking of generation and transport of solar magnetic flux. For our work we have used stream functions similar to those used by \emph{Hazra, Karat et al. (2014)} to replicate Zhao's velocity profile, and the standard solar model by Christensen-Daalsgard to calculate travel time differences for this profile. We have used the standard ray approximation to the 3-D wave equation, and considered only the first bounces of acoustic waves at the upper turning points. Our theoretical results fail to replicate Zhao's travel time results; this leads us to conclude that the present research cannot conclusively establish the presence of a second meridional cell, and further research including analysis of longer-duration data is needed to settle the matter one way or the other.

SSS-35	ASI2015_890	Gopal Hazra	Poster

Bidya Binay Karak, Nordita, Sweden Dipankar Banerjee, IIA Bangalore and Arnab Rai Choudhuri, IISc Bangalore.

Correlation between Decay Rate and Amplitude of Solar Cycles as Revealed from Observations and Dynamo Theory

Using different proxies of solar activity, we have studied the following features of solar cycle. (i) A linear correlation between the amplitude of cycle and its decay rate, (ii) a linear correlation between the amplitude of cycle n and the decay rate of cycle (n−1) and (iii) an anti-correlation between the amplitude of cycle n and the period of cycle (n−1). Features (ii) and (iii) are very useful because they provide precursors for future cycles. We have reproduced these features using a flux transport dynamo model with stochastic fluctuations in the Babcock-Leighton α effect and in the meridional circulation. Only when we introduce fluctuations in meridional circulation, we are able to reproduce different observed features of solar cycle. We discuss the possible reasons for these correlations

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ASI-2015 Poster Presentations

Stars, The Milky Way Galaxy and its neighbours

SG-1	ASI2015_363	Margarita Safonova	Poster

Yu. A. Shchekinov (Department of Space Physics, SFU, Rostov on Don, Russia), J.~Murthy (Indian Institute of Astrophysics, Bangalore, India) , Anuj Jaiswal (IIT, Delhi)

Age aspects of habitability

Is age of the planet important for its habitability? If we define habitability as the ability of a planet to develop life, then probably not. After all, life on Earth has developed within only 800 Myr after formation---the carbon isotope change detected in the oldest rocks indicates the existence of already active life at least 3.86 Ga (Gyr ago), at the end of the period of late heavy bombardment. If, however, we define habitability as our ability to detect life on the surface of extrasolar planets, then age becomes a crucial parameter. Earth became visibly habitable only about 750--600 Ma when the planet emerged from the one having a simple biota to a planet with diverse complex life (at ~ 540 Ma) capable of changing the environment enough to be noticed from space. Mars, for example, can still be inhabited at present (primitive subsurface biota) but unless the habitability is a global planetary phenomenon, it would remain undetectable. The importance of planetary age for detectability of life as we know it follows from the fact that the primary process, the photosynthesis, is endothermic with an activation energy higher than temperatures in habitable zones. Photosynthesis is currently the only known to us process that can provide sufficient energy to change the global planetary properties. We show that the onset of photosynthesis on planets in habitable zones may take much longer time than the current planetary age. The knowledge of the age of a habitable planet is important for developing a strategy to search for exoplanets carrying complex (developed) life--- many confirmed habitable planets are too young (orbiting Pop~I stars) and may not have had enough time to develop and/or sustain life. We discuss recent observational exoplanetary data from this point of view and suggest that recently discovered EMP stars (belonging presumably to an intermediate Pop~II.5 stars) seem to be good candidates for direct detection of orbiting Earth-size rocky planets in the IR and sub-mm wavelengths. In general, IR and sub-mm observations of rocky planets orbiting low-mass old stars seem a promising way to trace biogenetic evolution on exoplanets in solar vicinity. Such planets have had sufficient time to develop life provided they are located within a habitable zone.

SG-2	ASI2015_376	Sushan Konar	Poster

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Nuling Radio Pulsars : A Statistical Study

Radio pulsars are strongly magnetized rotating neutron stars and are characterized by their short spin periods ($P \sim 10^{-3} - 10^2$~s) and large inferred surface magnetic fields ($B \sim 10^8 - 10^{15}$~G). Abrupt cessation of their pulsed radio emission for several pulse periods, observed in some hundred odd pulsars, is known as the phenomenon of nulling. The nature and degree of this nulling varies from pulsar to pulsar. Detailed investigations of the nulling behaviour of individual pulsars and theoretical modeling of the phenomenon have been undertaken by many individuals/groups. However, except for some of the pioneering studies (Rankin 1986; Biggs 19992; Wang, Manchester & Johnston 2007) comprehensive statistical study of nulling has not been given a lot of attention. Given the existing data it is now possible to find the statistical characteristics of the population of nulling pulsars. We investigate this. In the analysis, we also include the intermittent pulsars and the rotating radio transients (RRAT). Recently, it has been suggested that there may exist a trend for nulling activity, going from ordinary nulling pulsars to intermittents to RRATs. Here we try to quantify the nulling behaviour to check for any difference between these different classes of pulsars. With that aim we find the proximity of a given object to the death-line. We quantify this proximity by a parameter q_d such that, $q_d = \tau_d / \tau_c$. Here τ_d is the time left for a pulsar to reach the death line assuming its magnetic field to remain constant at the present value. And τ_c is the characteristic age of a pulsar given by $P/\dot{P}$. Evidently, the value of τ_d depends on the choice of a particular death-line. We find that for any assumed death-line the statistical distribution of q_d for ordinary nulling pulsars is very different from that of the RRATs. We also address the issue of birthrates which has been considered by Keane & Kramer (2008). The observed and the predicted birth rates of the neutron stars differ by a large amount, the predicted one being higher. The major problem is concerning the birthrate of the RRATs, which is highest among rotation powered pulsars (RPP), X-ray dim neutron stars (XDINS) and Magnetars. This suggests that somehow RRATs need to be linked with these populations through some evolutionary pathways. Statistical tests performed by us again indicate that RRATs are different from the nulling/non-nulling pulsars, i.e., the population of RPPs. References : 1. Biggs J. D., 1992, ApJ, 394, 574 2. Keane, E. F., Kramer, M., 2008, MNRAS, 391, 2009 3. Rankin J., 1986, ApJ, 301, 901 4. Wang N., Manchester R. N., Johnston S., 2007, MNRAS, 377, 1383

SG-3	ASI2015_392	Jeewan Chandra Pandey	Poster

Subhajeet Karmakar

X-ray flares on two active stars pi1 UMa and 47 Cas

We investigate the properties of quiescent and flaring coronae of active stars π^1 UMa and 47 Cas using XMM-Newton observation. For both system the quiescent state coronae consist two temperatures, which are less than 10 MK. The quiescent state X-ray luminosity of Ppi^1 UMa and 47 Cas are found to be 7.4×10^{28} and 3.54 \times 10^{30} erg s^{-1} ~in 0.3-10.0 energy band, respectively. In case of π^1 UMa, two flares with X-ray luminosities of 1.2×10^{29} and 1.1×10^{29} erg/s were detected during the observation, where temperature corresponding to hot component were increased to 11.3 and 9.6 MK, respectively. However, the time-resolved X-ray spectroscopy of a flare from 47 Cas showed a variable nature of temperature, emission measure and abundances. The maximum temperature during this flare was found to be 72.8 MK. The loop lengths were estimated of the order of 10^{10} cm for all flares. Using high resolution X-ray spectra, densities during flares were found to be of the order of 10^{10} cm^{-3}.

SG-4	ASI2015_394	Sachindra Naik	Poster

Gaurava K. Jaisawal Physical Research Laboratory

Be/X-ray Binary Pulsar EXO 2030+375 with Suzaku

Timing and spectral studies of Be/X-ray binary pulsar EXO 2030+375 were carried out during two Type I outbursts of different intensity. The observations were made with the X-ray observatory Suzaku at the peak of both the outbursts. Pulsations were clearly detected in the X-ray light curves of the pulsar. The pulse profiles were found to be peculiar. During 2007 May outburst, a series of absorption dips were seen in the pulse profiles. However, during 2012 May outburst, the observed single-peaked narrow profile at soft X-rays (0.5-10 keV range) changed to a double-peaked broad profile in 12-55 keV energy range and again reverted back to a smooth single-peaked profile at hard X-rays (55-70 keV range). The 1.0-100.0 keV broad-band spectrum of the pulsar was found to be well described by three continuum models such as (i) a partial covering high energy cut-off power-law model, (ii) a partially absorbed power-law with high-energy exponential rolloff and (iii) a partial covering Negative and Positive power law with EXponential (NPEX) continuum model. During the 2007 May outburst, several low energy emission lines were detected in the spectrum whereas during 2012 May observation, a weak and narrow Iron emission line at 6.4 keV was only present in the pulsar spectrum. The details of the results obtained will be presented.

SG-5	ASI2015_402	MRIDUSMITA BURAGOHAIN	Poster

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Theoretical study of interstellar deuteronated polycyclic aromatic hydrocarbons

Emission features in infra red (IR) lying between 3-20 μm are proposed to arise from the relaxation of vibrationally excited Polycyclic Aromatic Hydrocarbon (PAH) molecules on absorption of UV photons [1]. Owing to the ubiquitous presence of these features, PAHs are believed to bear about 5- 10% of the interstellar carbon. Widespread presence of PAHs in the Interstellar Medium (ISM) also points to their stability and the possibility that they might be the most likely candidate carriers for Diffuse Interstellar Bands (DIBs) as well. The proposed interstellar PAH family includes deuterated PAHs (PADs), which result from the exchange of interstellar deuterium with the peripheral hydrogen atom of PAHs. The 4.4 and 4.6 μm feature detected in the Orion bar are attributed to the C-D stretching of PAHs containing deuterium [2]. Here, we report preliminary analysis of the vibrational properties of medium sized, symmetric and compact deuteronated PAHs (dPAH+) using Density Functional Theory (DFT). A comparison has also been made to understand PAH properties in terms of size and different charged states. References [1] Tielens, A. G. G. M. 2008, ARA&A, 46, 289 [2] Peeters, E., Allamandola, L. J., Bauschlicher, C. W., Jr., et al. 2004, ApJ, 604, 252

SG-6	ASI2015_406	Shruthi S Bhat	Poster

Shruthi S Bhat (Christ University, Bangalore) Dr.Paul.K.T (Christ University, Bangalore) Dr.Annapurni Subramaniam (Indian Institute of Astrophysics, Bangalore)

Spectroscopic study of Classical Be Stars: 4 Her and 88 Her

We present preliminary results of the spectroscopic study of two Be Stars, 4 Her and 88 Her. The time series spectra of these Be stars were obtained using the Universal Astronomical Grating Spectrograph (UAGS) at the Cassegrain focus of the 1 m reflector of Vainu Bappu Observatory, Kavalur, India. We obtained a total of 41 spectra for 4 Her and 32 spectra for 88 Her during April to July 2009, with 1Å resolution at Hα. The spectra were reduced and calibrated using the routines in IRAF. The rotational velocity vsini of the two stars were measured using HeI absorption lines (4026Å and 4471Å). The stars exhibit double peaked Hα profile and is used to estimate the V/R ratio as its variation. Both the stars exhibit spectroscopic variations in the Hα emission line. Short-term cyclic V/R variability within a period of few months for 4 Her is detected. We discuss their circumstellar environments based on the V/R variability.

SG-7	ASI2015_413	Soma Mandal	Poster

Ranjeev Misra, IUCAA, Pune

Energy dependence of r.m.s amplitude of low frequency noise and kHz Quasi periodic oscillations in 4U 1608-52

The neutron star low mass X-ray binary 4U 1608-52 is known to show kHz QPOs as well as low frequency broad band noise.The energy dependence of the fractional r.m.s of these variations reflect the underlying radiative mechanism responsible for the phenomena. In this work we compute the energy depedence for 26 instances of kHz QPO observed by RXTE. We typically find as reported before, that the r.m.s increases with energy with slope of ~0.5.This indicates that the variation is in the hot thermal compotonization componenet and in particular the QPO is likely to be driven by variation in the thermal heating rate of the hot plasma. For the same data, we compute the energy dependent r.m.s variability of the low frequency noise component by considering light curves binned at 10 secs. In contrast to the behaviour seen for the kHz QPO, the energy dependence is nearly flat i.e. with slope ~0. This indicates that the driver here may be the soft photon source. Thus the radiative mechanism driving the low frequency noise and the high frequecncy QPO are different in nature. This is against a simple resonance model where the QPO is simply a resonance at a particuler high frequency which amplifies the underlying noise. Alternatively, if the QPO is a resonance, then the noise at kHz frequencies is of different origin that that observered at low frequencies.

SG-8	ASI2015_438	Abhishek Johri	Poster

Nimisha G. Kantharia, Anish D. Roshi

Radio Recombination Line emission from Galactic star forming regions

Radio Recombination Lines (RRLs) are powerful diagnostic of ionized component of inter-stellar medium (ISM). Being extinction-free, RRL traces the ISM for a range of temperature and density conditions at very large distances in Milky Way. Frequency of the RRL depends on the principle quantum number ($\approx$ n^{-3}). The observed hydrogen recombination line (RL) are typically broad ($\Delta{V} \approx 30 km{s}^{-1}$) indicating their origin in the hot ionized gas near to the ionizing source. Hydrogen, carbon and heavier element RLs with narrow line width ($\Delta{V} \approx$ 5 to 10 $km{s}^{-1}$) are also observed, which either originate in relatively cool partially ionized medium (PIM), at the interface of ionized gas and neutral gas, or photo-dissociation region (PDR) outside the H\small{II} region. \\ We will be presenting our results on RRLs observation of Galactic star forming region near 20cm (n=172). The aim of this study is to understand the detailed physical properties (temperature, density, origin and excitation) in the H\small{II} regions and the surrounding PIM and PDR. \\

SG-9	ASI2015_447	Yogesh Maan	Poster

B. C. Joshi (NCRA, Pune) and Arun K. Naidu (NCRA, Pune)

A Search for Giant Pulses from Millisecond and Young Pulsars

Only a handful of radio pulsars are known to occasionally emit giant pulses that are narrower and stronger than the average pulse by several orders of magnitude. Although various properties of giant pulses have been studied in detail, true identifying characteristics of the pulsars that emit giant pulses, and the physical mechanism by which giant pulses are generated, are still poorly understood. A better understanding of these aspects essentially needs identifying, and then studying, a larger sample of giant pulse emitting pulsars. With this motivation, we are searching for giant pulse emission from a carefully chosen sample of millisecond and young pulsars, using the Giant Metrewave Radio Telescope and the Ooty Radio Telescope. We will present our optimized search methodology for this survey as well as the preliminary results from the search completed so far.

SG-10	ASI2015_453	Gireesh Chandra	Poster

H. C. Chandola Department of Physics, Kumaun University, Nainital

Spatial and dynamical properties of Open Star Clusters NGC 2099 and NGC 6866

Keeping in view the fact that the Open Star Clusters (OSCs) are the ideal tracer of galactic evolution and star formation process, two important large OSCs, viz. NGC 2099 and NGC 6866, have been studied especially for estimating their parameters and the dynamical behavior. Using the radial density profiles of these clusters, the radii of NGC 2099 and NGC 6866 have been estimated as 18 and 21 arcmin respectively. Since, the field of view of each cluster is contaminated by a large number of field stars, the dynamical, statistical and CMRD approaches have been used for such field star separation and 1600 members in NGC 2099 and 1357 members in NGC 6866 have been found in the cleaned CMD. Using the spatio-kinematic probability criteria of membership determination, the said members (of each OSCs) have been divided into the groups of most probable, probable, likely and boundary-line members. Furthermore, among the said members, NGC 2099 and NGC 6866 have been shown to have (25 YSO, 20 VRS and 242 k-excess) and (16 YSO, 12 VRS and 128 k-excess) members respectively. The best fit isochrones in color-magnitude diagrams have been shown to provide the apparent distance-modulus, reddening and log-age parameters for NGC 2099 and NGC 6866 as (11.3 mag, 0.29 mag and 8.7) and (10.95 mag, 0.11 mag and 8.85) respectively. The TCD associated with the said clusters, have been used to compute the total-to-selective extinction ratio in the direction of cluster to compare with its normal value. The dynamical state of said clusters have also been investigated through mass-function, mass-segregation and the relaxation time.

SG-11	ASI2015_458	Tapas Baug	Poster

D.K. Ojha and K.K. Mallick, Tata Institute of Fundamental Research.

Multi-wavelength study of the star-forming region Sh-138.

We have performed spectroscopic and photometric study of the star-forming region Sh 138. We obtained optical, near-infrared (NIR) and radio observations of the region using HCT and GMRT. The optical and NIR spectroscopic and photometric observations were carried out using HFOSC and TIRSPEC, respectively. We have detected about 400 and 500 sources, in the optical VRI and NIR JHKs bands respectively, in the central 4X4 square-arcmin region (implies to 5.8X5.8 square-pc in the sky plane). In an earlier study, Deharveng et al (1999) detected one young stellar object (YSO) in this region. But they concluded that there are possibly four O-B2 stars which are ionizing the region and this region is as complex as Orion Nebula. We could identify two YSOs using slit-less spectra in narrow H-alpha band and both of them shows spectral types earlier than B0 in our analysis. The optical and NIR spectra of bright YSO show strong hydrogen lines in emission. Another YSO is in the fainter regime to record any spectra. A neutral hydrogen map has been developed from the observed radio data. Spitzer infrared spectra (Spitzer-IRS) of this region show ArII, ArIII, SIV and NeII emission lines. A detail analysis of this region is in progress and final results will be presented.

SG-12	ASI2015_493	Joe Philip Ninan	Poster

D.K. Ojha et al. TIFR, Mumbai

V899 Mon (IRAS 06068-0641): A unique outburst source in the family of FUOrs/EXors

Low mass young stellar objects accrete gas from its disc in episodic events. These sudden increase in accretion rate happens by a factor of 10 to 100 and lasts only for a short duration.These outbursts are classified as FUors (lasting many decades) and EXors (lasting few years). They typically show a sudden increase in brightness by ~5 mag in optical bands. These short time scale outbursts can explain many issues related to low mass star formation like "Luminosity problem". They have been observationally found to influence the silicate crystallization and other disc chemistry, which could play crucial role in planet and comet formation. Due to their short time scale, these events are very rare, and we have to deduce the physics behind the phenomena from a dozen of sources discovered so far. Among the sample of all these sources we have been continuously monitoring, V899 Mon (IRAS 06068-0641) showed many unique properties. This source was first reported by CRTS survey in 2009. Our recent optical and near-IR, photometry observations showed rapid variability in flux and associated change in color and circumstellar extinction. Instead of undergoing a steady outburst, it went to quiescent phase in 2011 and also a short temporary dimming in 2014 August. The optical and near-IR spectra also showed rapid variation in its forbidden lines and PCygni outflow signatures. We present results from our multi wavelength study of this object from Optical, Near-IR, Far-IR to Radio from GMRT; and the physical characteristics obtained of the poorly understood FUors phenomena.

SG-13	ASI2015_499	Preethi K	Poster

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THREE DIMENSIONAL EXTINCTION MAP AND CATALOG OF ~0.16 MILLION WHITE DWARFS

We have used photometric data of point sources from Sloan Digital Sky Survey (SDSS) Data Release 8 (DR8) and its cross-matched Galaxy Evolution Explorer (GALEX) General Release 6 (GR6) data from the merged catalog on the CasJbos server. Only unique cross-matches that were classified as stars by the SDSS pipeline were selected, giving us a sample of about 1.8 million stars. Using a model based approach instead of colour-colour diagrams, we were able to classify all point sources by type, which showed nearly 80% to be extragalactic sources such as galaxies and quasars, while rest of them constituted galactic main sequence stars, red giants and white dwarfs. Parameters such as, spectral type of star, galaxy type, distance towards the galactic objects, photometric redshift towards galaxies and quasars, and line of sight extinction towards all sources were determined as a result of the fitting procedure. Of these, about 1.6×10^5 point sources were classified as white dwarfs with distance and extinction towards each of them, and these will be main focus of the paper. The number and spatial distribution of these white dwarfs have been studied and consequently their scale height estimated to be 390 pc. This catalogue of white dwarfs, along with the photometric data and best-fit parameters will be made available as online material. Using these 0.16 million white dwarfs, we have derived a three dimensional extinction map of our Galaxy up to a heliocentric distance of 600 pc in steps of 100 pc and in bins of 1 square degree. We have also derived extinction maps for a smaller subset of white dwarfs with an error-cut in the photometric magnitudes. The extinction map covers an area of 16, 200 square degrees, around 40% of the sky. The variation of extinction with galactic latitude and distance has been examined and results were compared with the integrated extinction map by Schlegel et al. (APJ, 500, 525, 1998), in addition to few other extinction studies. We find our extinctions to be underestimated at low latitudes and overestimated at high latitudes compared to that from Schlegel et al. (APJ, 500, 525, 1998), with a mean difference of about 0.002 mag, in case of the extinction map that includes all about 0.16 million white dwarfs.

SG-14	ASI2015_509	Md Shah Alam	Poster

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Simultaneous Appearance of Millihertz QPO and Broad Iron Line from Black Hole Binary System LMC X-1

We present the timing and energy spectral analysis of the black hole X-ray binary LMC X-1 using XMM-Newton and Suzaku observations. We report the discovery of low frequency ~ 26-29 mHz quasi-periodic oscillations (QPOs) with weak fractional rms amplitude in the ~ 1-2 % range and quality factor Q % 2-10. The energy spectra consists of three components - multicolour disk blackbody kTin ~ 0.7-0.9 keV, high energy power-law tail (Gamma ~ 2.4-3.3) and a broad iron line at 6.4-6.9 keV. The broad iron line, the QPO and the strong power-law component are not always present but the QPOs and the broad iron line appear to be clearly detected in the presence of a strong power-law component. The broad iron line is found to be weaker when the disk is likely truncated and absent when the power-law component almost vanished. These results suggest that the QPO and the broad iron line together can be used to probe the dynamics of the accretion disk and the corona.

SG-15	ASI2015_511	Sindhu N	Poster

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Simulations of old open clusters for UVIT on ASTROSAT

We present the simulations for three old open clusters M67, NGC 188 and NGC 6791 for the Ultra Violet Imaging Telescope (UVIT). UVIT is one of the payloads on the first multi wavelength satellite ASTROSAT expected to be launched by ISRO launch vehicle PSLV in the year 2015. The colour magnitude diagrams and spatial appearance of these cluster have been created using 10 filters in FUV (125 - 180 nm) and NUV channels (200 - 300 nm). The CMDs are simulated for different filter combinations and they are used to identify the locii of various evolutionary sequences, white dwarfs, blue stragglers, red giants, sub giants, turn off stars and the main sequence of the clusters. The present work helps in identifying the potential area of study in the case of three old open clusters, by considering the availability of filters and the detection limits of the instrument. We also recommend filter combinations which can be used to detect and study the above mentioned evolutionary stages. We compared our simulations with the GALEX data for two filters and they are found to be similar. The simulations and the results are essential for the optimal use of the UVIT for studies of old open clusters.

SG-16	ASI2015_512	Rajiv Kumar	Poster

Indranil Chattopadhyay, Affliation- ARIES, Nainital.

Dissipative advective accretion disc with variable adiabatic index around black holes

We investigated accretion on to black holes in presence of viscosity and cooling, by employing an equation of state with variable adiabatic index and multi-species fluid. We obtained the expression of generalized Bernoulli parameter which is a constant of motion for an accretion flow in presence of viscosity and cooling. We obtained all possible transonic solutions for a variety of boundary conditions, viscosity parameters and accretion rates. We identified the solutions with their positions in the parameter space of generalized Bernoulli parameter and the angular momentum on the horizon. We showed that a shocked solution is more luminous than a shock-free one. For particular energies and viscosity parameters, we obtained accretion disc luminosities in the range of $10^{-4}-1.2$ times Eddington limit, and the radiative efficiency seemed to increase with the mass accretion rate too. We found steady state shock solutions even for high-viscosity parameters, high accretion rates, and for wide range of composition of the flow, starting from purely electron-proton to lepton-dominated accretion flow. However, similar to earlier studies of inviscid flow, accretion shock was not obtained for electron-positron pair plasma.

SG-17	ASI2015_517	MAYUKH PAHARI	Poster

Ranjeev Misra IUCAA

Correlated study among time lag, energy and rms spectral properties across superluminal Radio jets in Black hole X-ray binaries

Superluminal Radio jets have been observed many times from Galactic black hole X-ray binaries (BHXBs) during near-Eddington regime of outbursts. They are usually associated with state transition from hard intermediate to soft intermediate state. A systematic study of the evolution of frequency and energy dependent time lag, fractional rms and time-averaged energy spectra during outbursts in BHXBs GX 339-4 and XTE J1550-564 show that a strong (upto 40 msec), hard/soft lag at low frequency between hard photons and soft photons vanishes with the launch of superluminal Radio jets and the integrated fractional rms drops simultaneously by a factor of 3-4. These observations are also found true for other BHXBs like GRS 1915+105, XTE J1748-288, GRO J1655-40 and V4641 Sgr. On the other hand, onset of transient Radio jets during soft to hard transition is also associated with the reappearance of strong, positive lag and increased fractional rms. Lag and rms spectral shapes also change significantly across jet profile providing a key indication on the connection between the origin of superluminal jets and state transitions with finer details. A correlation between energy spectral properties and observed lag and rms spectral properties across ballistic jets is searched for different black hole mass as well as spin parameter ranges.

SG-18	ASI2015_520	Priya Hasan	Poster

Ashraf L. Tadross; Reda Bendary; National Research Institute of Astronomy & Geophysics, Egypt

Photometric Studies of NGC 6631 and Mayer 3

We have obtained the BVRI CCD photometry down to a limiting magnitude of V ~ 20 for the southern poorly studied open cluster NGC 6631 and Mayer 3. It was observed from the 1.88 m Telescope of Kottamia Observatory in Egypt. The main photometric parameters have been estimated and compared with the results that determined for the cluster using JHKs 2MASS photometric database. NGC 6631's diameter is estimated to be 10 arcmin; the reddening E(B-V)= 0.68 ± 0.10 mag, E(J-H)= 0.21 ± 0.10 mag, the true modulus (m-M) o = 12.16 ± 0.10 mag, which corresponds to a distance of 2700 ±125 pc and age of 500 ± 50 Myr. The complete analysis for Mayer3 will also be presented.

SG-19	ASI2015_522	Manoj Puravankara	Poster

B. Gonzalez_Garcia, R. Vavrek (HSC, ESA, Madrid, Spain), D. Watson (Univ. of Rochester, USA), S. T. Megeath (Univ. Of Toledo, USA) & the Herschel Orion Protostar Survey (HOPS) team

Herschel spectral mapping of the OMC-2 region: spatial distribution and excitation conditions of the shocked gas in outflows from protostars

The OMC-2 region is one of the most active star-forming complex in the Orion A cloud and contains some of the most luminous protostars in the entire Orion cloud, notably OMC-2 FIR 3 and FIR 4. These protostars are also the brightest line emitters among the low-mass protostars observed with Herschel. The low excitation CO observations show collimated outflows centered on the more luminous FIR 3, with one lobe extending up to FIR 4; no evidence for outflow from FIR 4 is seen in the low excitation line maps. We have obtained and analysed high spatial resolution spectral line maps of the OMC-2 region centered around these two protostars with the PACS and SPIRE instrument onboard Herschel. Spatial distribution of molecular lines (CO, H2O & OH) and fine structure lines ([OI] & [CII]) observed with Herschel indicate that currently shocked gas (T = several 100s to a few 1000 K) traced by the high-excitation lines in the far-infrared have a very different morphology and spatial distribution than the cold gas (T < 100 K) traced by low excitation submm/mm molecular lines. High excitation line maps appear to indicate the presence of a powerful, but compact outflow driven by FIR 4. We have further analysed the excitation conditions of the hot and warm emitting gas surrounding these two protostars to study the mechanisms responsible for the heating of the gas in the OMC-2 region. We will present our analysis and results in this contribution.

SG-20	ASI2015_523	Mayuresh Surnis	Poster

B. C. Joshi (National Centre for Radio Astrophysics, Pune, India), M. A. McLaughlin (Department of Astronomy and Astrophysics, University of West Virginia, Morgantown, USA), P. K. Manoharan (Radio Astronomy Centre, National Centre for Radio Astrophysics, Ooty, India), Krishnakumar M. A. (Radio Astronomy Centre, National Centre for Radio Astrophysics, Ooty, India)

PSR J1839+1523: an intermittent pulsar with unpulsed radio emission

We report the discovery and follow-up timing of a new intermittent pulsar PSR J1839+1523 made in a Galactic plane survey conducted with the Giant Metrewave Radio Telescope (GMRT). During the follow up timing observations, the pulsar could not be detected for 280 days. Since it started being detected again, the ON and OFF emission states have not been quasi-periodic as reported for PSR B1931+24. We see that the spin-down rate is different for each ON phase with a different profile each time, in stark contrast to observations in other intermittent pulsars. We also report on the detection of continuum, unpulsed radio emission seen in the images made during the OFF states.

SG-21	ASI2015_525	Gaurava Kumar Jaisawal	Poster

Authors: Gaurava K. Jaisawal & Sachindra Naik Affiliation: Physical Research Laboratory, Navrangapura, Ahmedabad

Timing and spectral studies of the high mass X-ray binary 4U 1700-37 with Suzaku

We present results obtained from the timing and broad-band spectral studies of the high mass X-ray binary 4U 1700-37 using data obtained from a Suzaku observation. The source was observed on 2006 September 13-14 during out-of-eclipse orbital phase of the binary. The light curves in soft and hard energy ranges showed significant variation in X-ray intensity during the Suzaku observation. We did not find any signature of X-ray pulsations in the soft and hard X-ray light curves of the source. However, a quasi-periodic oscillation (QPO) feature at ~20 mHz was detected in the power density spectrum of the source. 1-70 keV time averaged source spectrum was found to be well described by a partially covering high energy cutoff power-law model and Negative and Positive power-law with Exponential cutoff (NPEX) model. The iron emission lines at 6.4 keV and 7.1 keV were detected in the spectrum. An absorption like feature was seen in the spectral residue when the time averaged spectrum was fitted with the NPEX continuum model. Interpreting the feature as cyclotron absorption line, corresponding magnetic was estimated to be ~3.4x10^12 Gauss.

SG-22	ASI2015_528	ANSHU CHATTERJEE	Poster

Lab Saha TIFR, Mumbai Pratik Majumdar SINP, Kolkata

Time dependent model of middle aged Pulsar Wind Nebulae

Pulsar Wind Nebulae(PWNe) constitute the largest class of identified galactic objects in VHE gamma-ray astronomy. The ultra-relativistic particle wind from pulsar energizes the ambient medium and forms a nebula around the pulsar. The evolutionary trends of photon spectrum of PWNe over its age are not completely known. A leptonic, time-dependent model of PWNe has been constructed. The model gives the time evolution of electron energy distribution of PWNe by solving time-energy dependent diffusion loss eqution. The time dependent electron energy spectrum is balanced by injection, energy loss and escape. Different types of radiative losses have been included due to the interaction of electron with magnetic and photon field. Loss mechanisms include synchrotron, inverse Compton(with different photon fields like CMB, FIR, NIR), self synchrotron compton(SSC) and bremsstrahlung processes. The escape term includes the effect of the high energy electrons escaping due to large Larmor radius. The central pulsar injects an electron spectrum into the nebula. The model will be applied to a set of middle age PWNe to study the possible existence of common evolutionary trends and to link them with the characteristics of the associated pulsar.

SG-23	ASI2015_553	Aru Beri	Poster

Biswajit Paul; Mauro Orlandini; Chandreyee Maitra; Raman Research Institute,Bangalore, India; INAF-IASF Bologna,Italy; AIM Saclay, France

Temperature Measurement of Thermonuclear X-ray bursts using Broadband X-ray Observations with Beppo-SAX

We will present measurement of temperature of thermonuclear X-ray bursts using broadband X-ray light curves from the Beppo-SAX observatory. Light curves obtained with the MECS and PDS instruments in a broad energy band of 1.8-30 keV have been used for measurement of the temperature evolution during these bursts . We have used the data from a total of twelve observations of six sources during which 22 bursts were detected. However, instead of carrying out time resolved spectroscopy, we have determined the temperature in small time intervals using the ratio of count rates in two instruments assuming blackbody nature of burst emission and appropriate interstellar absorption for the respective sources . We have obtained temperatures as high as ~ 3.0 keV during some of the bursts, even when there is no evidence of photospheric radius expansion. Moreover, these high temperatures were observed in the sources during different spectral states. We will discuss the implications of relatively high burst temperatures obtained with the Beppo-SAX broadband data.

SG-24	ASI2015_559	Ananta Charan Pradhan	Poster

Ananta C. Pradhan (NIT, Rourkela), Parthasarathy M. IUCAA, Pune), Jayant Murthy (IIA, Bangalore), D. K. Ojha (TIFR, Mumbai)

The GALEX observations of Planetary Nebulae.

We present the first ultraviolet photometric observations of planetary nebulae (PNe) using observations made by Galaxy Evolution Explorer (GALEX). We found about 120 PNe observed by GALEX. We have determined the angular diameter of PNe in NUV and also in FUV for whichever source detection exists considering a 3-sigma emission level above the background . We then compared and discussed the sizes of these PNe with the sizes obtained at other wavelengths. We have also discussed ultraviolet spectra and morphology of some of the prominent PNe in our sample.

SG-25	ASI2015_596	Bhal Chandra Joshi	Poster

L. Supan, G. Castelletti, M. P. Surnis, D. Supanitsky

Radio study of TeV sources from new GMRT observations

A number of TeV sources have been discovered by High Energy Stereoscopic System (HESS) in the last decade. Out of these, TeV sources associated with Supernova Remnants (SNRs) are particularly important due to the possibility of presence of a putative pulsar and associated Pulsar Wind nebula, which can power the TeV source by leptonic mechanisms. Alternatively, these sources can also be powered by a hadronic scenario due to interaction of SNR with its surrounding. Here, we report on results from a project, being carried out with the GMRT, to understand the nature of these sources. We have completed a study of two such sources and work is in progress for three more sources. In particular, recent results of simultaneous imaging and pulsar observations of HESS J1818-154/G15.4+0.1 with the GMRT will be presented. No spectral index trace, indicating a radio counterpart to the pulsar wind nebula proposed from X-ray observations, was found in this source. In addition, the search for radio pulsations yielded negative results. Presence of interacting molecular cloud, evidenced in CO observations and an impressive agreement between emission at far infrared wavelengths and the molecular cloud, suggest a hadronic origin of TeV emission. However, our modeling of SED for the source implies that the TeV emission could be due to either a purely hadronic or leptonic model and further sensitive observations at MeV energies are needed to better constrain its SED.

SG-26	ASI2015_599	Kaushal Sharma	Poster

Mina Koleva (Ghent University, Belgium), H. P. Singh (Department of Physics & Astrophysics, University of Delhi, Delhi, India), Ph. Prugniel (Observatoire de Lyon, Saint-Genis Laval, France)

Validating stellar population models resolved in chemical abundances

The evolution of the star-foramtion rate and the total metalliciity with time in unresolved galaxies is now accessible to us, thanks to the enormous progress in the stellar population models and advances in the inverse techniques. The next step is to follow the evolution of individual element abundances, which can trace the relative importance of different types of stars to the galactic chemical enrichment. Indeed, first empirical models resolved in alpha-elements (excessively produced by super novae type II) are becoming available (Walcher et al 2009, Prugniel & Koleva 2012, Vazdekis et al in prep). Before applying them to distant galaxies, the first necessary step will be to test them with near-by resolved and known systems as the Galactic Globular Clusters. Here, we use the library of Schiavon et al 2005 to test these models and indicate their successes and pit-falls.

SG-27	ASI2015_600	Nazma Islam	Poster

Biswajit Paul (Raman Research Institute), Biman B. Nath (Raman Research Institute) et al.

Long term averaged and composite spectrum of X-ray binaries

X-ray binaries are highly variable and occupy a broad range of spectral states. The energy spectra of X-ray binaries have been investigated during the last few decades with many observatories in different energy bands and with different spectral capabilities. However, these studies are carried out in selected states of X-ray binaries like during outbursts, transitions, quiescent states, and are always done in limited time windows of pointed observations. Wide field monitoring with the all sky monitor MAXI, which also has a broad energy coverage, provided us the first opportunity to investigate the long term average spectra of a large number of X-ray binaries. We will present the long term averaged X-ray spectrum and the composite X-ray spectrum of galactic X-ray binaries spectra with 5 years of MAXI data. The composite X-ray binaries spectra are constructed separately for the for high and low mass X-ray binary population, accounting for circumstellar absorption as well as unabsorbed spectra. These composite X-ray binary spectra will be useful in future studies to obtain realistic estimates on the fractional contribution of hard X-rays in heating of intergalactic medium during the epoch of reionization.

SG-28	ASI2015_621	Debdutta Paul	Poster

Manoj Puravankara, Tata Institute of Fundamental Research

Far-infrared spectroscopy of Orion protostars with Herschel/PACS: Protostellar evolution in diverse environments

The early protostellar evolution is driven by the balance between in-fall, accretion and outflows, processes that can heat up the surrounding gas up to a few thousands Kelvin. The important cooling lines of the warm and hot circumstellar gas lie in the infrared wavelength range. We have obtained 50 to 200 micron spectra of some 30 protostars in the Orion molecular clouds as part of the Herschel key program the Herschel Protostar Survey (HOPS). Our sample of protostars span a large range in luminosities (1 - 300 L_sun) and evolutionary stages (Class 0 & I and Flat spectrum) and are located in vastly different environments; it is the largest sample far-infrared spectra of protostars from a single star forming region to date. We have successfully developed a semi-automated algorithm for identifying spectral lines in the far-IR spectra. We have analyzed rotational transitions of CO, ortho and para-H2O lines, OH lines and atomic forbidden lines ([OI]) to constrain the excitation conditions in the emitting gas. We searched for correlations between the estimated physical properties of the emitting gas and the protostellar properties to identify the processes responsible for the heating of the warm (~300 K) and hot (~1000 K) gas surrounding protostars. We will present the results of this statistical study and discuss their implications for our understanding of the earliest phase of star formation.

SG-29	ASI2015_624	Arun Kumar Naidu	Poster

B. C. Joshi (NCRA,Pune) P.K Manoharan (ORT,ooty)

Interesting nulling behaviour of PSR J1709-1640

Pulsars null on wide range of timescales (single rotational period to few months). J1709-1640 belongs to small class of pulsars which null on intermediate timescales (~hour). Such pulsars represent important link between the classical nullers (whose emission vanishes few rotations and the intermittent pulsars which null for months and years. We have observed this pulsar for ~50 hours using Ooty Radio Telescope (ORT). Unlike its counterparts whose inactive states are fairly regular, this pulsar goes into inactive state very rarely (~ 5 days). This makes a unique addition to the sample of intermediate nullers. A part from occasional inactive states this pulsar has regular nulls. We have identified and characterized the nulling behaviour of this pulsar. We will present these results.

SG-30	ASI2015_628	Prahlad Epili	Poster

Gaurava K. Jaisawal Sachindra Naik Affiliations: Astronomy & Astrophysics Division Physical Research Laboratory Ahmedabad-380009, India

Suzaku observations of KS 1947+300 during an X-ray outburst

We present the results obtained from the timing and spectral studies of the Be/X-ray binary pulsar KS 1947+300 during its 2013 October-November outburst. For the present study, we used data obtained from Suzaku observations of the pulsar at two epochs e.g. on 2013 October 22 and November 22. X-ray pulsations at ~18.81 s were clearly detected in the light curves of the pulsar upto as high as 100 keV. The pulse profiles of the pulsar was found to be single-peaked upto ~10 keV beyond which a sharp peak followed by a dip like feature appeared in the hard X-ray profiles. Pulse-phase averaged spectrum of the pulsar was found to be well described with two different continuum models such as (i) Negative and Positive power law with EXponential (NPEX) cut-off and (ii) high energy cutoff power law model. Additional spectral components such as blackbody and Gaussian function were required for soft X-ray excess and iron emission lines in the pulsar spectra. In the spectral fitting, we also detected earlier reported cyclotron resonance scattering feature at ~12 keV. Pulse-phase resolved spectroscopy was carried out to understand the changes in spectral properties of the pulsar at different pulse phases. The details of the results obtained will be presented in the meeting.

SG-31	ASI2015_645	Priyanka Chaturvedi	Poster

1.Abhijit Chakraborty, A&A division, PRL, 2. B. G. Anandarao, A&A division, PRL

Title: Estimation of spectroscopic parameters of host stars in eclipsing binary systems from PARAS

Physical Research Laboratory Advanced Radial-velocity Abu-sky Search (PARAS) at 1.2 m telescope is a high-resolution echelle spectrograph (R~67000) dedicated for exoplanet and eclipsing binary studies. Radial velocity technique gives the lower limit of mass of the companions in the binary systems whereas the high resolution spectra from PARAS can also be helpful in constraining the spectroscpic parameters of the host stars. Accurate determination of host star properties is important in proper estimation of mass and age of the companion giving insights on the stellar structure and evolution process of the binary system. We have developed an indegenous package to determine the stellar properties of the host star which compares the observed spectra to a series of models generated by the synthetic spectral library obtained from the SPECTRUM program. The instrument and the analysis procedure for the determination of spectroscopic properties will be described in brief including its application for one of the candidates from the SuperWasp catalogue where the companion lies between the boundary of M dwarfs and Brown Dwarf regime.

SG-32	ASI2015_659	K. Sriram	Poster

P. Vivekananda Rao Dept. of Astronomy Osmania University Hyderabad

CCD photometric study of the contact binary KP 301148

Contact binaries are important astrophysical sources as they help to understand the underlying mechanism of merging process (eg. V 1309 Sco; Tylenda et al. 2011), stellar dynamo process (Qian et al. 2005), contributing for the understanding of galactic structure, due to their high number density (1/500 MS stars; Rucinski 2002), binary evolution theories (Yakut & Eggelton 2005) and also serve as distance estimators (Rucinski & Duerbeck 1997). We present the CCD photometric study of a contact binary KP 301148 using IGO 2.0m telescope In V passband. The light curve is modeled using the WD code version 2013. The various parameters are determined and the evolutionary status is discussed.

SG-33	ASI2015_663	Padmakar Singh Parihar	Poster

1. Parvez Reza Saleh, Guahati University, Gauhati, Asam India 2. Shantikumar N.S., Indian Institute of Astrophysics, Bangalore 560034, India.

Exploring the disk accretion in young stellar object DF Tau

The low mass young stellar objects of class II, popularly known as a classical T Tauri stars (CTTS) are suppose to be surrounded by thick flared disk and accrete disk material through strong stellar dipolar magnetic field. The disk accretion rate and its variation with time is poorly know. DF Tau is an interesting CTTS binary system, shows peculiar behavior, linked with both disk accretion as well obscuring effect of a clumpy disk. Over last ten years this object is being spectroscopically as well as photometrically monitored using HCT. The data has been analyzed and modeled using a simple modeling technique developed by us. In this paper, first time we report our result related to the disk accretion phenomena in DF Tau.

SG-34	ASI2015_683	Gayathri Raman	Poster

Biswajit Paul^1, Dipankar Bhattacharya^2 Vijay Mohan^2 1: Raman Research Institute 2: IUCAA

SALT observation of X-ray pulse reprocessing in 4U 1626-67

We investigate the optical reprocessing of X-rays in the LMXB pulsar 4U1626-67 in its current spin-up phase using the South African Large Telescope (SALT) and present the results of timing analysis. Using observations carried out on 5th and 6th March, 2014, we detect some interesting reprocessing signatures. The absence of optical Quasi Periodic Oscillations (QPOs) in the power spectrum from both the night's data was an expected out come, characteristeric of the spin-up phase of the source, as no corresponding X-ray QPO is seen during this phase. In the lightcurve obtained on March 5, we detect a coherent pulsation at the known spin period of ~7.676 s. A previously known, slightly down-shifted side-band feature is also detected at 129.94 mHz. The frequency spacing between the main pulse and this side-band is currently being examined. The lightcurve of March 6 displays short time-scale variability in the form of flares on timescales of a few minutes. The folded pulse profiles resulting from the data of this night show an interesting trend of the pulse peak drifting with time. Further investigation of the same is in progress.

SG-35	ASI2015_693	Arti Joshi	Poster

Arti Joshi & Jeewan C. Pandey Aryabhatta Research Institute of obsrvational Sciences, Nainital-263002

Paloma: Bridging the gap between Polars and Intermediate Polars

Using the data from observation made with XMM-Newton, we present temporal and spectral analysis of an intermediate polar-like object Paloma. From the X-ray data, we report two persistent periods at 156±6 min and 130±4 min, which we interpreted as orbital and spin periods. We also interpreted Paloma is a key object for magnetic CV evolution with an orbital period right within the period gap. The averaged spectral data obtained from the XMM-Newton European Photon Imaging Camera is composed with an optically thin plasma emission components at 0.09 keV and 12.5 keV, which is strongly absorbed by dense material with an equivalent hydrogen column density of 6.1×10^22 cm-2 partially covering 64% the X-ray source together with one Gaussian at 6.4 keV Fe emission line. We also present the orbital and spin phase-resolved spectroscopy for Paloma in 0.3-10.0 keV energy range.

SG-36	ASI2015_696	Lalitha Sairam	Poster

Singh, K.P., Drake, S., Kashyap, V.

Outer atmospheres of HD 155555 system

The RS CVn binaries are a class of tidally locked, rapidly rotating close binaries typically composed of a chromospherically active G- or K-type stars with a late-type subgiant or main-sequence companion. We will present our ongoing work on a systematic and detailed study of coronal X-ray emission from a bright young pre-main-sequence RS CVn system--HD 155555, using Chandra HETG/MEG gratings. This system is a triple star system composed of a G5 IV, K0 IV and M3V stars. The G (HD 155555 A) and K stars (HD 155555 B) are short period binaries with an orbital period of 1.68 d. The M dwarf companion HD 155555 C is 33$"$ away from the close-in binary system. Both HD~155555~AB and HD~155555~C are strong X-ray sources with log~L$_X$ of 30.54 and 29.30, respectively. We have analysed the dispersed spectra of both HD~155555~AB and HD~155555~C using discrete temperature APEC models, and have constructed the emission measure distribution (EMD) using spectral line analysis (using the ATOMDB 2.0) and consequently obtained the elemental abundances from EMD and examined the FIP effect. From an analysis of He-like triplets of Si XIII, Mg XII and Ne IX, we have derived the coronal electron densities of $\sim$10^{10} cm^{-3}. Finally, we compare our results with those of other bright RS CVn types, like, AR Lac and TW Hya, which is slightly older than and younger than HD 155555, respectively.

SG-37	ASI2015_706	Kaustubh Rajwade	Poster

Yashwant Gupta, Ujjwal Kumar - National Centre for Radio Astrophysics-Pune and Mihir Arjunwadkar - Centre for modeling and simulation, University of Pune, Pune

Probing nulling in milli second pulsars with the GMRT

Over the past several years, the phenomenon of pulse nulling has been studied for many 'normal' period pulsars. These studies, which require measurement of single pulse energies, have revealed a wealth of information which has helped in improving our understanding of the emission mechanism of pulsars. Studies of pulse nulling for Milli-Second Pulsars (MSPs) are relatively more difficult as they are much fainter in flux. Till date, results are available in literature for only one MSP -- PSR J0437-4715. Pulse nulling studies of MSPs will be crucial in understanding their emission behaviour and to see if phenomena like pulse nulling are relevant in the regime of lower magnetic fields and faster spin rates. The GMRT, due to its high sensitivity, offers a good option to probe nulling in MSPs. In this paper, we present results of the nulling analysis of five MSPs using data from the GMRT at 325 MHz. For each pulsar, we do an analysis of the energy histograms to estimate the limits of the Null Fraction (NF), which is the measure of the fraction of pulses in a pulse sequence which null. We confirm that PSR J0437-4715 does not null after analysing 1000000 pulses. In cases of other MSPs, where the Signal to noise ratio (S/N) is not sufficient, we integrate subsequent pulses so that the S/N is high enough to obtain an upper limit on the nulling timescale. As there are limitations of S/N on the above method of estimation of NF, we explore new ways of analysis. Using novel technique of gaussian mixture modelling, we are able to get stronger constraints on the NF of these pulsars. Our results show, with good statistical certainty, that 3 of the 5 pulsars do not show evidence of nulling. For the remaining 2, we get an upper limit on the nulling timescale. In conclusion, we are able to get NF estimates for the largest sample of MSPs so far, and the results suggest that nulling is absent in these MSPs.

SG-38	ASI2015_708	Firoza K. Sutaria	Poster

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Type-II Supernovae in the local Universe.

Core collapse supernovae in massive stars (type-II SNe) have several implications for the chemical and physical evolution of the host galaxy. A statistical study of type-II SNe at low redshifts is presented here, using results obtained from the various transients detection programs. The aim is to study the distribution and the rate of various classes of core-collapse SNe, as a function of the morphology, the dynamical and the star-formation history of the local group of galaxies. Results on the nature of the progenitor (as a function of SNe-II morphology), obtained from our program to study bright, nearby, SNe-II,are also presented, and interpreted in the context of the evolutionary history of the local group of galaxies.

SG-39	ASI2015_714	Bharat Bhushan Singh	Poster

Varsha Chitnis, TIFR R. J. Britto, University of Johhanesburg, A. Shukla, TIFR, L. Saha, TIFR, B. S. Acharya, TIFR

Observations of Crab nebula/pulsar with HAGAR telescope array

HAGAR is a system of seven Non-imaging Atmospheric Cherenkov Telescopes located at Hanle in the Ladakh region of the Indian Himalayas at an altitude of 4270 meter amsl. Since 2008, we have been observing Crab nebula/pulsar to assess the performance of the HAGAR telescopes as well as to detect pulsations. Technique used for analysis of HAGAR data will be discussed. Using 103 hours of data, we have detected Crab nebula at a significance level of 18 sigma at energies above 234 GeV. Also there is an indication of pulsations with period of 33 ms. Details of these results will be given.

SG-40	ASI2015_816	Nandita Lahkar	Poster

S Kalita, Gauhati University, H L Duorah, Gauhati University, K Duorah, Gauhati University.

Synthesis of Li and B in SN II progenitors with the help of neutrinos.

Synthesis of Li and B in astrophysical environments is still an area of intensive study. In this work, attempt is made to understand the production of these two elements in type II supernovae (SN II) environment. Here neutral current neutrino interaction is considered in the He – zone of SN II progenitors of 8, 10 and 20 solar masses. The yield is found to be high for the low mass progenitors in comparison to that of the higher mass progenitors. The results are compared with those of some existing models and the consistency is critically discussed.

SG-41	ASI2015_825	Ramya M Anche	Poster

A. N. Ramaprakash (IUCAA), G.C. Anupama (IIA), V. Mohan (IUCAA)

Polarization properties of the 2011 outburst of the recurrent nova T Pyxidis

The recurrent nova T Pyxidis underwent its seventh and most recent outburst on 2011 Apr 14.29. Optical, broadband photo-polarimetric observations were obtained with the 2m IGO telescope on a few occasions during the early phases of the outburst. The results of these observations are presented, interpreted in the context of the overall evolution of the outburst.

SG-42	ASI2015_833	Krishnakumar M.A	Poster

Mitra, D Naidu, A Joshi, B.C Manoharan, P.K NCRA-TIFR, Pune.

Scatter broadening measurements of 124 pulsars at 327 MHz

Pulsar signals are affected by the fluctuations of the electron density in the Interstellar medium. These fluctuations give rise to random variations in the refractive index of the medium. The pulsar signal traverses through such irregularities and gets scattered in the process. This essentially broadens the otherwise narrow pulse with an exponential decay which has a characteristic timescale τ_{sc}, known as the scatter broadening time. Measurements of such pulse broadening timescales can be used to probe the morphology of the interstellar medium in the pulsar line of sights. For a Kolmogorov distribution of irregularities, τ_{sc} scales as $C^{2}_{n_e}\nu^{-4.4} DM^{2.2}$, where $C^{2}_{n_e}$ is the scattering strength in the line of sight to the pulsar, DM is the dispersion measure of the pulsar and ν is the observing frequency. Hence, the pulse broadening due to scattering will dominate the intrinsic pulse width evolution at meter wavelengths for $DM > 100$ pc/cc. In this study, we present such measurements of τ_{sc} for 124 pulsars at 327 MHz, observed using the upgraded Ooty Radio Telescope (ORT). These pulsars lie in the DM range of 37 -- 503 pc/cc and declination (δ) range of $-$57$^{\circ} < \delta< 60^{\circ}$. New τ_{sc} estimates for 58 pulsars are presented for the first time, increasing the sample of all such measurements by about 40\% at 327 MHz. Using all available τ_{sc} measurements in the literature, we investigate the dependence of τ_{sc} on DM. Our measurements, together with previously reported values for τ_{sc}, affirm that the ionised interstellar medium upto 3 kpc is consistent with Kolmogorov spectrum, while it deviates significantly beyond this distance.

SG-43	ASI2015_842	Nagendra Kumar	Poster

Ranjeev Misra IUCAA, Pune-411007, India

Rapid variability in NS LMXBs and the thermal Comptonization process.

In neutron star low-mass X-ray binaries (NS LMXBs) system the X-ray photons varied rapidly (of order of milliseconds), this variability has quasi periodic nature (termed as kHz QPO) and occurred frequently in lifetime. The X-ray spectrum is explained usually in terms of thermal Comptonization process and it is correlated with kHz QPOs. We have described a thermal Comptonization model for kHz QPOs in NS LMXB which also constrained the size of the Comptonizing medium with comparing the energy dependency of kHz QPO. We have explored the relation between medium size and kHz QPO frequencies for both type of LMXBs transient and persistent source, but this relation depends on adequate spectral modeling. In transient source, for one spectral model, the medium size is increased as kHz QPO frequencies are decreased but not such clear distinction for other spectral model. In addition, to explain the time lags (between two energy band) associated to kHz QPO frequencies, we have taken an additional assumption that significant fraction of Comptonized photons impinge back to the seed photon source. To check this assumption we have set up a Monte Carlo experiment for Compton scattering process and studied the relation between fraction of return back Comptonized photons and the geometry of the comptonizing system.

SG-44	ASI2015_905	Prajval Shastri	Poster

Prajwel P J(Christ University),A. Rozario (Christ University, Bengaluru), M. Safonova (Indian Institute of Astrophysics, Bengaluru), P. Shastri (Indian Institute of Astrophysics, Bengaluru)

Search for IMBHs from Microlensing in Globular Clusters

Although there has been no conclusive observational evidence for the Intermediate mass black holes (IMBH) in spite of substantial theoretical backing, it has long been suggested that small stellar systems such as dwarf galaxies and globular clusters (GC) may host central IMBH. Most attempts to demonstrate their existence are indirect and present enormous observational difficulties due to crowding of stars. In 2010 our group has initiated monitoring of a set of selected GCs looking for possible gravitational microlensing signature of a putative central black hole (BH). Here the BH acts as a lens, inducing amplification of light of globular cluster stars passing behind. We are developing a semi-automated data pipeline to transform hundreds of CCD frames into interpretable light curves and extract variability, both periodic and non-periodic. This is a flexible modular pipeline, built with IRAF and shell scripts, that has wide applicability. The pipeline includes the differential imaging analysis --- the DIAPL package developed by W. Pych (2012). We will demonstrate the fast performance of the first three modules of the data reduction pipeline in this presentation. We also present the first results of our project -- the differential imaging analysis of the GC M13 and describe the steps we are employing to put a limit on the presence of an IMBH.

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ASI-2015 Poster Presentations

General Relativity and Cosmology

GRC-1	ASI2015_479	PRAKASH SURYAKANT GAIKWAD	Poster

Tirthankar Roy Choudhury (NCRA), R. Srianand (IUCAA), Vikram Khaire (IUCAA)

Signatures of Helium reionization in Quasar Absorption Spectra

At present it is believed that the reionization of singly-ionized helium (HeII) occurred around redshifts $z \sim 3$ because of the rise in quasar population. This alters the thermal state of the intergalactic medium (IGM), in particular it leads to a rise in the temperature. Thus the study of thermal evolution of IGM can provide useful insight about its ionization state. Because of reionization of HeII, the mean temperature T_0 and the equation of state γ of the IGM is expected to change considerably. It is expected that one can understand these effects by studying the thermal broadening of absorption lines in the Lyα forest of quasar absorption spectra. In this talk we present the constraints on T_0 and γ using simulations of Lyα forest and comparing with high resolution observations of quasar absorption spectra. The method for putting constraints is based on wavelet analysis of Ly-α forest transmitted flux and optical depths. The probability distribution function of wavelet power is used as calibrator between observed and simulated spectra. We have verified our method by applying it on simulated test spectra (T_0 and γ are known). The method is then applied on observed spectra for different redshift bins so that the redshift evolution of T_0 can be constrained. We find that the constraints can be improved if one uses optical depth reconstructed from HI Ly-α forest instead of HI Ly-α transmitted flux. We have studied how the constraints depend on systematics such as noise, number of spectra, cosmic variance, metal line contamination etc.

GRC-2	ASI2015_492	Suvodip Mukherjee	Poster

Tarun Souradeep, IUCAA

Imprint of Isotropy Violated Gravitational Wave Background in CMB

The Standard Cosmological Model is based upon the Cosmological Principle that the Universe on large scales is isotropic and homogeneous. But the recent measurements from Planck temperature field have made a significant detection of dipolar modulated temperature field of Cosmic Microwave Background (CMB) which implies a departure from the isotropic cosmological model. This observed dipolar anisotropy is present only in large angular scale and leads to a scale dependent modulation amplitude. In the talk, speaker will describe a new phenomenological model arising from a non isotropic inflationary model which can explain the observed large scale dipole anisotropy without considering scale dependent modulation amplitude. This model arises due to initial directional dependent inflationary parameters and keep its imprints on both the temperature and polarization field. The key signature of this model is the direction dependent tensor to scalar ratio and also an statistically anisotropy B mode polarization of CMB. This feature is measurable from several missions like Planck, BICEP-2 and PRISM and hence the validity of the model can be investigated. This analysis leads to a detailed understanding of the observed isotopy violation and also shed light on the cosmological model beyond standard ΛCDM. To investigate the observed statistically anisotropic feature in details from future missions, it is essential to make temperature and polarization realizations of CMB which are manifestly statistically anisotropic. In the talk, the speaker will discuss an efficient and fast numerical code CoNIGS to make statistically anisotropic Gaussian simulations of temperature and polarization field which can incorporate any kind of isotropy violation and can be used for the analysis in any future high resolution CMB missions.

GRC-3	ASI2015_535	Reju Sam John	Poster

Surajit Paul, Dept. of Physics, University of Pune. Harish Kumar, Dept. of Physics, Pondicherry Engineering College.

Evolution of the energy distribution in the Intracluster Medium during large scale structure formation

In the hierarchical structure formation framework, galaxy clusters are the biggest objects in the universe. They grow by continuous accretion and mergers, which in turn induce turbulence flow and shock wave. This large-scale shocks can be an important sources of cosmic rays (CRs) in the universe. These cosmic rays are extremely important as it can efficiently influence the structure formation and evolution. Since the galaxy cluster merger has a large evolution time (>Giga years), it is impossible to observe the entire evolution, but only a snap shot of the different stages. Simulation of such events thus became inevitable. We performed cosmological hydrodynamic simulations using ENZO 2.2 to study the galaxy cluster merger and hence the large-scale shocks. Shock finding in our simulations is accomplished by means of unsplit velocity jumps across the simulation grids. In particular, we studied the evolution of both thermal and non thermal energy released during merger event. This enabled us to compute the thermal energy fraction transferred to cosmic-rays by diffusive shock acceleration (DSA). Using the scaling law computed by Kang et al. 2007, we computed the cosmic ray fraction in the merging galaxy systems. We found a nice correlation among the mass of the merging galaxy-clusters and cosmic ray flux emanating out of the system. We also found during the mergers, cosmic ray flux goes up by many times. Correlation of merging phases and cosmic ray flux will definitely help us to decide the state of different observed galaxy clusters.

GRC-4	ASI2015_560	JAYANTI PRASAD	Poster

JAYANTI PRASAD, Inter-University Centre for Astronomy Astrophysics, Post Box 4, Ganehskhind, Pune - 411007

Revisiting cosmological parameter estimation

Cosmic Microwave Background (CMB) anisotropies on the sky are the goldmine of cosmological information like physical densities of the baryons and dark matter, dark energy density, nature and strength of primordial density perturbations which lead to structure formation in the universe etc. In order to get useful information from the CMB experiments like WMAP and Planck we must reduce the huge volume of data these experiments generate first into multi-frequency maps and then into angular power spectrum from which theoretical models can be constrained (CMB anisotropies are considered isotropic and Gaussian so power spectrum has all the information which we have in the CMB sky). In order to estimate the parameters of theoretical models, like ΛCDM, Bayesian approach is generally followed in which we sample the multi-dimensional parameters space using Markov-Chain Monte Carlo (MCMC) methods and compute the marginalized values of the parameters and error bars on them from the sampled points. In the present work we show that Particle Swarm Optimization (PSO) which is a population based search procedure can not only find the values of the cosmological parameters which give best likelihood for the WMAP and Planck data, it can also sample the parameter space quite effectively, to the extent that we can process the PSO sampled point in the way as we process MCMC sampled point. We also compare PSO with Downhill-Simplex method of Nelder \& Mead and Powell's method of Bound Optimization BY Quadratic Approximation (BOBYQA) in this work.

GRC-5	ASI2015_587	Shishir Sankhyayan	Poster

Joydeep bagchi (IUCAA, Pune), Prakash Sarkar (TIFR, Mumbai), Varun Sahni (IUCAA, Pune), Joe Jacob (Newman College, Kerala)

Extremely Large Scale Structures in Galaxies Redshift Surveys

We have initiated the search and detailed study of large scale structures present in the Universe using large galaxies' redshift surveys. In this process, we take the volume-limited sample of galaxies from Sloan Digital Sky Survey – III and find very large structures even beyond the redshift of 0.2. One of the structures is even greater than 500 Mpc which raises a question on the homogeneity scale of the universe. The shapes of voids-structures (adjacent to each other) seem to be correlated, which supports the physical existence of the observed structures. The other observational supports include galaxy clusters' and QSO distribution's correlation with the density peaks of the volume limited sample of galaxies. We also give the statistical distribution of voids and superclusters in the selected region. Further we plan to analyze the role of Dark Energy in the formation of very large structures and the evolution mechanism of galaxies within these structures by studying their member galaxies in detail.

GRC-6	ASI2015_647	Abir Sarkar	Poster

1) Subinoy Das Indian Institute of Astrophysics Bangalore,India 2) Shiv.K.Sethi Raman Research Institute Bangalore, India

How Late can the Dark Matter form in our universe?

We put constraints on the epoch of dark matter formation for the case of certain non-wimp candidate where dark matter appears in between the epoch of Big Bang Nucleosynthesis and matter radiation equality. In such class of models, matter power spectra gets a strong suppression even towards linear scale, if dark matter is formed considerably close to the epoch of matter radiation equality and thus subject to strong constraints from linear power spectra measurement from SDSS and Lyman-alpha data. Unlike the case of warm dark matter, where mainly mass of the dark matter particle controls the suppression scale, in "Late forming dark matter" scenario, it is the redshift of dark matter formation which determines the free streaming scale in power spectra. We use SDSS and lyman-alpha data to directly nd the latest epoch of dark matter formation in our universe. If all the observed dark matter is late forming, we find lower bound on redshift of dark matter formation z_f > 1.08*10^5 at 99.73 % C.L from the SDSS data and z_f > 9* 10^5, at the same C.L, from the Lyman-alpha data. If only a fraction of the dark matter is late forming then we find tentative evidence of the presence of LFDM from the Lyman-alpha data. Upcoming data from SDSSIII/Boss will allow us to explore this issue in more detail.

GRC-7	ASI2015_747	Naseer Iqbal	Poster

Naseer Iqbal, Tabasum Masood and Nessar Demir. 1,2: Department of Physics University of Kashmir Srinagar India. 3: Department of Physics, Kuwait UNiversity Kuwait.

The Entropy of Cosmological Many Body Problem and its Behavior

The work compiles a correlated study of a gravitational quasi equilibrium thermodynamic approach for establishing and signifying a unique behavior of the cosmological entropy. On the basis of prescribed boundary conditions for Z and Z N , the temperature profile of the intra-cluster medium (ICM) is self-explanatory. A more productive and signifying approach of the correlation functions used for galaxy clustering phenomena predicts a unique behavior of entropy change where a phenomenon known as the gravitational phase transition occurs. This unique behavior occurs with a symmetry breaking from mild clustering to low clustering and from mild clustering to higher order clustering, which differs from a normal symmetry breaking in material sciences. We also derive the first results for the latent specific heat associated with the phase transitions of 2.59 kB Tc and 0.55 kB Tc for the mildly clustered phase to the low clustered phase and from the mildly clustered phase to the highly clustered phase respectively.

GRC-8	ASI2015_751	Surajit Paul	Poster

Luigi Iapichino (Leibniz-Rechenzentrum, Garching, Germany); R. S. John (Pondichery University); G. D. Harale (Pune University)

Galaxy Cluster merger blast wave, an engine of Cosmic Ray production

Explosions play very important role in the formation or emergence of many astrophysical systems. Immediate result of an explosion is the blast wave formation. In astrophysics, Supernovae explosions are the ideal example of such events. But, huge energy can even be released in much larger gravitational collapse like galaxies and clusters of galaxies, especially during their mergers. To study the dynamics and energetics of such events, we used ENZO-2.1 hydrodynamic code to study massive galaxy cluster merger phenomena. It is observed in our study that the formation of Mega parsec scale merger shocks in such events substantially change the energy distribution of Inter Cluster Medium. A striking similarity is noticed between expanding intra cluster medium during mergers with the blast wave formation in supernovae explosions. This study of ours thus reporting the largest known blast wave in this universe with an extension greater than 1 Mpc. Such a gigantic shock wave also act as the particle accelerator that can accelerate particles to an energy as high as ~ 10^19 eV, the highest energy detected in this universe. Lastly, we found that such explosions help to re-populate and re-energize the voids which is extremely important finding as such events might be in conflict with the statistical expectations of the CDM model.

GRC-9	ASI2015_757	Gajanan Dnyaneshwar Harale	Poster

Surajit Paul (Department of Physics, SP Pune University) Luigi Iapichino (Leibniz-Rechenzentrum, Garching, Germany) and Karl Mannheim (Lehrstuhl für Astronomie, Universität Würzburg)

Forming galaxy clusters are the major source of cosmic neutrinos and ultra high energy particles

Recent findings show an isotropic distribution of neutrinos on the observed sky, which indicates its extragalactic origin. Galaxy clusters being the most massive and energetic object, are an obvious test bed for the studies of Ultra High Energy (UHE) particle origin search. We thus investigate the role of stricture formation shocks in forming galaxy clusters as the mechanism for accelerating particles to such an ultra high energy. Our calculation shows that the galaxy cluster collisions can accelerate particles to an energy higher than 10^19 eV with a very steep spectral index > 2. These Cosmic Rays then losses energy via hadronuclear interactions and produces gamma rays and neutrinos as by product. This study of ours also reveals that such systems can be a source of more than 20% of the total neutrino background emission and UHE particles detected.

GRC-10	ASI2015_759	A Pavan Kumar	Poster

Nidhi Pant, Aditya Rotti, Tarun Souradeep

Recovering hidden signals of anisotropy from CMB maps and trist with mask

Any isotropy violating phenomena on CMB, such as low-l hemispherical power asymmetry, local motion, lensing, etc, induces subtle off-diagonal correlations in the two-point function, which can be used to independently estimate these anisotropic signals themselves. We developed an estimation procedure based on the bipolar shperical harmonic (BipoSH) formalism, which allows a complete description of two-point correlation function on a sphere. To avoid biases due to foreground contamination, omitting (masking) regions of the CMB sky where the reconstruction is unreliable is a conventional practice in CMB analyses. Partial sky survey also leads to a similar situation as masking. Masking or availability of partial sky complicates the recovery, and is accute for estimating a subtle signal such as Doppler boost. In this work, we demonstrate that the effects of masking, and any spurious correlations thus induced can be comprehensively addressed within the BipoSH framework to successfully recover hidden signals of anisotropy in observed CMB maps. This method is generic, and can be applied to variety of isotropy violating signals. We specifically discuss recovery of Doppler boost of CMB and low-l hemisphrical power asymmtery which is phenomenologically modeled as dipole modulation of CMB anisotropies.

GRC-11	ASI2015_783	pranita das	Poster

H.L.Duorah and Kalpana Duorah, Dept. of Physics, Gauhati University

Dark Matter annihilation as a source of energy

Most mysterious matter in the universe is Dark Matter. Weakly interacting massive particles (WIMPs) are the most interesting cold dark matter candidates produced in the early Universe. It is believed that Dwarf spheroidal galaxies are the best location to search DM.These are known as most dark matter dominated objects.Dark matter can be searched in these locations by WIMPs annihilation into high energy radiation. Here we have assumed neutarlino as WIMP. In our study we consider Draco and Ursa minor galaxy. For all dSph DM density profile is considered to be same. NFW density profile is considered . In this paper we have estimated the luminosity of dSph by annihilation of neutralino (WIMPs).

GRC-12	ASI2015_809	Haris M. K	Poster

Archana Pai

Aperture Synthesis in GW inspiral search

Gravitational Wave inspiral search with a global network of interferometers when carried in a phase coherent fashion mimics a search with two effective synthetic data streams. The two synthetic data streams pertaining to the two polarizations of Gravitational Wave can be derived as a linear combination of over-whitened data from individual detectors prior to the Maximum-Likelihood analysis in a most natural way using the technique of singular-value-decomposition (SVD) applied to the network signal-to-noise ratio vector. The network Log Likelihood Ratio(LLR) is then the sum of the LLRs of these synthetic streams. The four extrinsic parameters of the non-spinning inspiral signal namely amplitude, initial phase, binary inclination and the polarization are mapped to two amplitudes and two phases. The maximization of LLR over the new extrinsic parameters is a straightforward exercise closely linked to the single detector approach in the literature.

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ASI-2015 Poster Presentations

Extragalactic Astronomy

EA-1	ASI2015_367	Tanvir Hussain	Poster

Sowgat Muzahid, PSU (USA) Anand Narayanan, IIST (India) Raghunathan Srianand, IUCAA (India) Bart P. Wakker, Wisconsin (USA) Jane C. Charlton, PSU (USA) Amit Pathak, Tezpur University (India)

HST/COS detection of a Ne VIII absorber towards PG 1407+265: An unambiguous tracer of collisionally ionized hot gas?

We report the detection of Ne VIII in a z_abs = 0.59961 intervening absorber in the high signal-to-noise HST /COS spectrum of the QSO PG1407+265 (z_em= 0.94). Besides Ne VIII, absorption from H I Lyman series lines (H I λ1025 – λ915) and several other low (C II, N II, O II and S II), intermediate (C III, N III, N IV, O III, S IV and S V) and high (S VI, O VI and Ne VIII) ionization metal lines is detected with > 3σ significance. Disparity in the absorption line kinematics between low and high ions implies that the absorber has a multiphase structure. Photoionization models suggest that the low and intermediate ions (except S V) trace a compact (∼ 410 pc), metal-rich (Z ∼ Z_⊙) and over-dense (log n_H ∼ −2.6) region. The estimated relative abundances of C, N, O, S, and Si are consistent with the solar values within 0.2 dex indicating that the photoionized gas was part of a region that sustained star-formation for a prolonged period. The observed column densities of Ne VIII and O VI in different components and the absence of Lyβ absorption in one of the components can be explained as arising in a low density (−5.3 < log n_H < −5.0), metal-rich (Z ∼ Z_⊙) and diffuse (∼ 180 kpc) photoionized gas. The S V, S VI and C IV (detected in an earlier FOS spectrum) column densities are consistent with an intermediate ionization phase with −4.2 < log n_H < −3.5. Alternatively, a pure collisional ionization model with 5.65 < log T < 5.72 can reproduce the observed column densities of S VI, O VI, and Ne VIII simultaneously in a single phase. However, even such models require an intermediate phase to reproduce any observable S V and/or C IV. Therefore, we conclude that a photoionization model is equally plausible as a collisionally ionized model for the origin of Ne VIII absorption in this system. This demonstrates that Ne VIII is not necessarily an unambiguous tracer of collisionally ionized hot gas as was suggested by all previous analyses of intervening Ne VIII systems. Searching for faint dwarf galaxies at low impact parameters in deeper images will provide further insights on the absorber that shows signature of being associated to star forming region.

EA-2	ASI2015_372	Ishwara Chandra CH	Poster

Ishwara Chandra CH and Sandeep Sirothia

Deep Radio Surveys at 325 MHz with GMRT

We have been carrying out deep radio survey of well known deep fields at 325 MHz with GMRT. This will be an excellent compliment to available deep radio observations at 1.4 GHz. The primary aim of these observations are to search for steep spectrum radio sources, which are strong candidates for high-redshift radio galaxies. Matching available deep optical and IR observations for these fields make them the most valuable data set for studying the evolution of radio loud AGNs. Here we describe goals of our programme, present preliminary results and focus on a few issues, like evolution of low power radio agn.

EA-3	ASI2015_411	Pratik Dabhade	Poster

Pratik Dabhade,Madhuri Gaikwad (University of Pune) & Joydeep Bagchi (IUCAA)

Discovery of 10 Giant radio galaxies

We present the discovery of ten new giant radio galaxies found from the The NRAO VLA Sky Survey (NVSS) which was released about 15 years ago, which signifies the importance of the survey and the fact that its far from becoming obsolete. All the sources are FR II radio galaxies with a projected linear size greater than 1 Mpc. GRGs are extremely useful laboratories for astrophysical studies and based on our current understanding and observations, they are the single largest objects in the universe.GRGs are rare among the entire population of radio galaxies (RGs) and their physical evolution is not well understood so far.These radio sources host a active galactic nuclei (AGN) at the center. It is believed that the central engine in the AGN is responsible for the production of bipolar relativistic jets. Since the GRGs are known expand to such enormous large sizes, they are thought to be the last stop of radio galaxy evolution and hence help us provide important constraints on the various evolutionary models. For the existence of the lobes at greater distances a working surface is essential or in other words some medium is necessary for the lobes to formed. The lobes of these radio sources are capable of compressing cold gas clumps and can set in motion ideal conditions for star or even dwarf galaxy formation, they can also contribute sigificantly in transporting gas from a host galaxy to large distances and seed the intergalactic medium (IGM) with magnetic fields. These objects are also most likely the candidates for accelerating particles to high energies. We also present the computed radio and the infrared luminosities of all the GRGs.The mass of the central black hole of GRGs has been determined using the M-sigma relation and K band bulge luminosity. The optical and radio observations clearly show that two of our new GRGs lie in a dense cluster medium which emphasizes that the environment does not play a major role in their exceptional large sizes. We have shown for first time the classification of GRGs into QSOs, LERGs, HERGs etc using the WISE color color plot. A more thorough radio studies of these GRGs at lower frequencies are neccesary to obtain its spectral index and map the diffused emission.

EA-4	ASI2015_435	Rajeshwari Dutta	Poster

R. Srianand (IUCAA), N. Gupta (IUCAA)

Cold HI 21-cm Absorption Line Survey

We are carrying out a systematic survey for 21-cm absorption in a sample of quasar sight lines passing through disks/halos of nearby galaxies (quasar galaxy pairs or QGPs) using 200 hours of GMRT time. Using SDSS and FIRST catalogs we have built a sample of 105 QGPs with small projected separation in the sky, b <= 30 kpc. Our galaxy sample spans a wide range of luminosity, morphology, impact parameter and environment. Thus, it will provide an important resource for understanding high-z galaxy evolution based on absorption line studies. From this parent sample, we have constructed a sub-sample of 36 QGPs for which we have the optical spectra from SDSS and our spectroscopic observations using SALT. Optical spectra of these quasars and galaxies are being utilised to measure the redshifts for conducting radio spectral line observations and to derive the galaxy properties. From our ongoing survey, we report 21-cm detection from two new QGPs. We wish to present these and upcoming results from our GMRT survey, which will allow us to infer correlations between properties of the absorbing gas and those of the host galaxies. Further, these results would be extremely relevant for interpreting on-going and future blind 21-cm searches at z > 2 where it is difficult to detect the associated galaxies.

EA-5	ASI2015_441	Mamta	Poster

F. Combes (LERMA, Observatoire de Paris, France) J. Bagchi (IUCAA, India) B. Guiderdoni(CRAL-l'Observatoire de Lyon, France) D. Narasimha(TIFR, India) J. Jacob (Newman College, Kerela, India)

Non-thermal emission in Galaxy clusters at high redshift range (z>0.3)

Galaxy clusters are the densest part of the large-scale structures of the Universe that are gravitationally bounded. The Intra Cluster Medium (ICM) consists of a mixture of hot plasma, magnetic fields and relativistic particles. These relativistic particle in the presence of magnetic field gives rise to rare non-thermal intra cluster emission whose existence and extent is now well established, thanks to high sensitivity observations. Low frequency radio observations (mainly with the GMRT) of the sky have revealed the presence of such non-thermal intra cluster diffuse radio emission in about 98 galaxy clusters as of now. This non-thermal diffuse emission is classified as centrally placed Mpc-scale radio halos and peripheral radio relics. In this presentation we will discuss about the new results obtained by the GMRT on a sample of clusters located at high redshift range (z>0.3).

EA-6	ASI2015_448	Yogesh Wadadekar	Poster

Yogesh Wadadekar (NCRA-TIFR), Aritra Basu (MPifR, Germany), Alexandre Beelen (IAS, France), Veeresh Singh (UKZN, South Africa), Sandeep Sirothia (SKA-SA and NCRA-TIFR), C. H. Ishwara-Chandra (NCRA-TIFR)

Radio-FIR correlation in blue-cloud galaxies with $z < 1$

We combine deep observations of the XMM-LSS field using Magellan, Spitzer, Herchel, VLA and GMRT telescopes to carry out a comprehensive observational study of the radio-FIR correlation in Milky Way like star-forming galaxies out to $z \sim 1$. We use stacking techniques to probe the correlation for galaxies that are upto 3 orders of magnitude fainter than those directly detected in FIR bands. We find that the tight radio-FIR correlation holds for these galaxies at all redshifts. Within the uncertainties of our measurement, there is no evolution of the correlation with redshift. However, we do find that the slope of the correlation is systematically different from unity and is steeper. The characteristic dust temperature evolves linearly with redshift. Some implications of these measurements to existing models will be discussed.

EA-7	ASI2015_450	SHWETA SRIVASTAVA	Poster

Carolina Kehrig(Instituto de Astrofisica de Andalucia, Granada, Spain), Nimisha G. Kantharia(National Centre for Radio Astrophysics, TIFR, Pune), J. M. Vilchez(Instituto de Astrofisica de Andalucia, Granada, Spain), J. Iglesias -Paramo (Instituto de Astrofisica de Andalucia, Granada, Spain)

A 2D view of nearby Wolf-Rayet galaxies

The main objective of this work is to do a comprehensive study of the Wolf-Rayet (WR) population, supernovae remnants (SNRs) and the properties of the ionized gas (metallicity, temperature, ionizing sources, etc) for a sample of nearby WR galaxies. We will use optical integral field spectrocopy in combination with multi-wavelength data, specially radio observations. Combining optical integral field unit and radio data, we will be able to locate the WR stars and SNRs across the WR galaxies, and to study the spatial correlation between them, and the ionized gas properties. This study will shed light on the massive star formation and its feedback, and will help us to better understand distant star-forming galaxies.

EA-8	ASI2015_451	Pramod Pawar	Poster

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X-ray and Optical/UV variability of NLS1 1H0707-495

Though accretion disk of AGN emit in optical/UV bands, primary emission occurs in the X-ray band and is believed to originate from the hot corona. In addition to this primary X-ray emission several other features e.g., the fluorescent Fe K_{alpha} line, reflection hump and soft excess emission are also observed which are attributed to the reprocesses taking place at different regions of the disk. The Fe K_{alpha} line and Compton hump are generally attributed to the reprocessing of primary X-ray power law by the disk, whereas, the soft excess is attributed to either thermal Comptonization of disk photons in an optically thick, cool plasma or to the blurred ionized reflection from the disk. Therefore, it is customary to investigate different mechanisms that are responsible for these emissions and also to investigate a possible connection between them, which cannot be addressed merely using spectroscopic techniques. However, as any reprocessing introduces an inter-band lag, correlated multi-wavelength variability has been identified as a key tool to investigate the physics of reprocessing. In this paper we present results derived from the analysis of simultaneous X-ray and optical/UV observations of narrow line Seyfert 1 galaxy 1H0707-495 using the XMM-Newton and SWIFT satellites. This study involves different statistical tools to investigate the inter-band correlation.

EA-9	ASI2015_457	Manojendu Choudhury	Poster

Pratik Majumder, SINP, Kolkata. C.H. Ishwara Chandra, NCRA-TIFR, Pune Ananda Hota, UM-DAE CEBS, Mumbai

Low Freuquency Radio Detection of Unidentified Gamma-ray Source

The Large Area Telescope (LAT) aboard the Fermi satellite has allowed us to study the high energy gamma-ray sky with unprecedented sensitivity. However, the origin of 31% of the detected gamma-ray sources remains unknown. The lack of counterpart at longer wavelengths might suggest that there are no sufficiently sensitive low energy observations of these sources. Multi-wavelength observations of these sources are fundamental to identify and reveal their nature, as well as to understand the physics behind these energetic sources. The identification of any of these sources, by locating its counterpart at radio, infrared, optical or X-ray wavelength would improve our knowledge of the emission processes at high energies and would help to solve the problem of unidentified high energy sources. We have started a longterm campaign to detect some of the unidentified sources in the low-freuqency radio regime from the GMRT, and propose to provide a complete picture using the existing observations and detections of these sources in other wavelengths. Here we report the detection of one source, 2FGL J0307.4+4915, in three frequencies. We also discuss the likely properties of this source.

EA-10	ASI2015_463	Katherine Rawlins	Poster

Gargi Shaw, UM-DAE Centre for Excellence in Basic Sciences, Mumbai

Physical conditions for two high redshifted damped Lyman alpha systems, DLAs at zabs = 2.3377 and zabs = 2.41837

Damped Lyman alpha systems (DLAs) are quasar absorption systems with neutral hydrogen column density greater than 2×1020 cm-2. They are considered to be star-forming regions which are the progenitors of present-day disk galaxies. Studying the physical conditions in DLAs is significant towards our understanding of galaxy formation and evolution. We have modelled two DLAs at zabs = 2.3377 and zabs = 2.41837, using the spectral synthesis code CLOUDY (http://www.nublado.org). These DLAs have been observed in absorption along the sightline towards the quasars LBQS 1232+0815 and SDSS J143912.04+111740.5 respectively. H2 has been detected in both DLAs, and the DLA at zabs = 2.41837 also has CO. We have predicted the density, radiation field, metallicity, dust grain size, composition and abundances of the DLAs self-consistently based on the observed column densities of various atomic and molecular lines. Our simulations suggest grain sizes smaller than the ISM dust grains for these two DLAs.

EA-11	ASI2015_477	Sonkamble Satish Shripati	Poster

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\title{AGN Feedback in strong cool core cluster Abell 2390}

We present systematic analysis \textit{Chandra} X-ray data on the strong cool core cluster Abell 2390 at z = 0.228 that host an energetic radio AGN. This analysis enabled us to investigate five X-ray deficient cavities in the surface brightness distribution of Abell 2390, located within the central 30 arcsec ($\sim$108 kpc), and were confirmed through a variety of image processing techniques. Temperature profile as well as 2D temperature map derived for Abell 2390 revealed structures in the distribution of ICM, in the sense that ICM in NW direction is relatively cooler than that on the SE direction. Unsharp masked image also reveals an X-ray edge at $\sim$ 268\,kpc on NW side and is found to coincide with the radio edge due to several compact radio sources. Tricolor map as well as hardness ratio maps detect cool clumps in the central 30\,kpc region with an average temperature $5.08_{-0.24}^{+0.25}$\,keV. The entropy profile at the core reveals a floor at 12.20$\pm$2.54 keV cm^2 and hence confirms intermittent heating by the central AGN. The diffuse radio emission mapped through 1.4\,GHz VLA L-band data exhibits spatial correspondence with all the X-ray cavities. Estimate of the kinetic power injected by the AGN in to the ICM is found to be 3.3$\times$10^{46} erg\,s^{-1} and is roughly two orders of magnitude higher than that lost by the ICM in the form of X-ray emission, implying that the AGN feedback is capable enough to quench the cooling flow in this cluster.

EA-12	ASI2015_480	Aditya J N H S	Poster

Nissim kanekar (Phd supervisor)

Cold gas in flat spectrum sources at high redshifts

Searches for HI-21cm absorption at the redshift of active galactic nuclei (AGNs) enable detailed studies of the kinematics and distribution of the neutral gas close to the AGN, important for understanding the physics of the AGN activity (which may be fuelled and perhaps even triggered by the neutral gas). Detections of associated absorptions may lead to determine possible variations in the inflow and outflow characteristcs with redshift, depending upon the absorption features which are redshifted or blueshifted from the systemic velocity. Also, detections of outflows of cold gas will establish the presence of feedack mechanism, operating in such systems, though determination of the exact mechanism, viz: AGN induced feedback or Stellar outbursts, may be done with the help of VLBI studies. Such associated HI-21cm absorption studies also allow direct tests of unification schemes for radio galaxies and quasars, which predict that the line of sight to broad-line radio galaxies is normal to the torus and the thick disk, while that towards narrow-line radio galaxies lies close to the plane of the disk. Searches for such absorbers over a wide redshift range will give insight into the possible evolution of AGN environments with redshift. Unfortunately, such associated HI-21cm absorption studies have mostly been carried out at relatively low redshifts, with only four detections at z>1. We are currently using the GMRT to probe AGN environments at high redshifts, out to z~3.6, by searching for associated HI-21cm absorption in a large flat-spectrum AGN sample.

EA-13	ASI2015_488	Miss Jogadand Sharada Keshav	Poster

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X-ray Binary Population in an edge-on lenticular galaxy NGC1332

We present the properties of the XRB population detected in 56 ks Chandra data on an edge-on lenticular galaxy NGC1332. We investigated spectral nature as well as counterparts in the XRBs in IR, Optical and UV bands. Combined X-ray luminosity function of the resolved point sources within optical D25 of the target galaxy is well described by a power law with a break at 2.5$\times$10^{38} erg s^{-1}, corresponding to the Eddintong limit of a 1.4 Msun neutron star. The X-ray color-color plot derived for the resolved sources enabled us to classify them as LMXBs, HMXBs, ULXs and field AGNs. The cumulative X-ray spectroscopy of the discrete sources within the optical D25 region is well constrained by a power law with the photon index of 1.45. Spatially resolved spectral analysis of the hot gas in this system exhibits structure in the temperature as well as metallicity. We also report the contribution of the XRBs to the total X-ray luminosity of the target galaxy.

EA-14	ASI2015_500	Ayesha Anjum	Poster

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Model based study of active galactic nuclei in optical and UV bands

There has been a considerable interest globally put-in by researchers to understand properties, structure and evolution of active galactic nuclei (AGN). AGN are the mostly studied luminous objects recently and are the developing counterparts of elliptical and spiral galaxies. We report here our results on the structure and formation of AGN and the role of central SMBH in the evolution of such AGN. Spectral energy distribution (SED) modelling is one of the best ways to study the structure, properties and evolution of such galaxies. We have studied a small sample of objects using CIGALE and have attempted to obtain physical properties of these objects. The optical data of these objects were taken from Sloan Digital Sky Survey (SDSS) and ultraviolet (UV) data from Galaxy Emission Explorer (GALEX). Python version of code investigating galaxy emission (CIGALE) is a recent tool capable of extracting fundamental physical photometric properties of AGN such as the star formation rate, redshift and luminosity of its host galaxy. pCIGALE operates in wavebands extending from far infrared to far ultraviolet. Spectroscopic properties such as the line profiles, emission and absorption properties can be dealt with using spectroscopic data available online specially from SDSS. The photometric and spectroscopic properties of them were obtained using model based analysis.

EA-15	ASI2015_518	main pal	Poster

Matteo Guainazzi (ESAC, Spain), Gulab Chand Dewangan (IUCAA, Pune)

Variations in the broadband X-ray continuum and Fe-K absorptions in NGC 3516

We present detailed study of highly ionised absorbers in NGC 3516 using available archival long five XMM-Newton and six SUZAKU observations. The Fe-K band shows sometimes relativistic absorption lines, so called ultrafast outflows. The geometrical structure, ionisation structure, location, origin and actual driver of these absorbers are still under debate. We detect them by a powerful technique described in Tombesi et al 2010 and then identify them. We detected He-like and H-Like transitions of FeXXV and FeXXVI, respectively, in the 6.4-9 keV band. These Fe-K absorbers are found to have outflow velocity in the 1500- 5000 km/s range. The absorption lines strengthen with the 4-10 keV flux of the powerlaw continuum. We found that the continuum slope is also highly variable ($\Gamma \sim 1$ - 2.1) in the 4-10 keV band. We will discuss the response of absorbers to the changes in the continuum spectral components.

EA-16	ASI2015_527	Kiran S Baliyan	Poster

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Signature of the precession of relativistic jet in blazars

The matter accretes on the black hole through the disc powering the relativistic jet, which dominates the emission at all wavelengths in blazars. The exact mechanisms responsible for the origin, acceleration and collimation of the jet are not well understood. Since central engine is not resolvable by any existing optical facility, variability in flux can be used as a tool to understand the structure and physical processes in the jet. Blazars show variability in their flux at all frequencies with time scales ranging from years to minutes and appear good candidates for such study. The physical processes responsible for such variations provide important clues to the nature of the jet and emissions from it. Long duration monitoring of blazars is expected to throw light on the long-term variability patterns of the source, which, in case of blazars, are imprints of the jet structure and dynamics. We have used long-term monitoring data from Mt Abu Observatory to construct light-curves for blazar S5 0716+714. The light-curve show that during 2005- 2012, source brightness decreased while it increased during 1996-2003. It was accompanied with decrease in viewing angle (angle between jet direction and the line of sight) from about 5 degree to about 2.0 degree during 1996-2003 and then increasing trend during 2003 – 2012 as determined from VLBI images. A decrease in viewing angle leads to enhancement of brightness. Available historical light-curves show a brightness decreasing trend during 1963 – 1981 and a fast increasing one during 1988-1995. This average brightness behaviour is superposed with slow flares and faster variations. Such long-term change in the brightness of the source associated with systematic variation in the viewing anlge indicates to precession of the relativistic jet on its axis. According to this, the average brightness of the source should start increasing sometime in 2015. Using our data and data from literature, we will discuss longterm behaviour of this blazar in the meeting.

EA-17	ASI2015_541	Nilkanth Vagshette	Poster

M. K. Patil, S. S. Sonkamble, Anil Kyadampure (S.R.T.M. University Nanded)

Heating and cooling mechanism in cool core cluster Zwcl 2701

Present work show the high spatial resolution of Chandra X-ray and GMRT 1.4GHz radio observations in the strong cool core cluster Zwcl 2701 (z=0.214). The X-ray and radio observations shows an extensive (kpc-scale) pair of X-ray cavity(or bubble) in East and west direction along with relative cool gas in central part. The X-ray temperature, density, pressure, entropy and metal abundance profile clearly reveal the cooling flow scenario. Apart from these we also directly measure the power of cavities which shows that the heating due to cavities on surrounding gas is sufficient to quench cooling flow mechanism.

EA-18	ASI2015_563	Pankaj Kushwaha	Poster

K. P. Singh (Tata Institute of Fundamental Research, Mumbai-400005), Sunder Sahayanathan (ApSD, Bhabha Atomic Research Centre, Mumbai-400085)

Understanding High Energy Emission from 3C 454.3

3C 454.3 belongs to flat spectrum radio quasar class of blazars – known for their highly variable non-thermal continuum emission across the electromagnetic spectrum from radio to γ-rays. The nature and origin of high energy emission (X-rays and beyond), however, is remain unclear as both the leptonic and hadronic models being able to reproduce it well. Further, the rapid broadband variability demands simultaneous multi-wavelength coverage and correlation analysis to unravel the same. Being one of the brightest γ-ray blazars in the GeV sky, 3C 454.3 is been a prime target of multi-wavelength campaigns, aimed at understanding the physical processes responsible for broadband emission. I will present a detailed systematic multi-wavelength spectral and temporal analyses along with spectral modeling of the source and discuss its implications on high energy emission and acceleration processes in the source.

EA-19	ASI2015_579	Lijo T George	Poster

K. S. Dwarakanath (RRI), N. Hurley-Walker (Curtin), M. Johnson-Holitt (Victoria University of Wellington), L. Hindson (VUW), GLEAM Survey members, MWA Builders List

MWA Observations of the galaxy cluster Abell 3376

Diffuse radio emission from galaxy clusters is detected in the form of central halos and/or in the form of peripheral relics. Clusters which show signs of merger activity are most likely to host these halos and/or relics. The galaxy cluster Abell 3376 (z = 0.046) contains two arc-like structures separated by ∼2 Mpc and is a brilliant candidate for “double relics” which are believed to trace the shocks travelling outward in the aftermath of a merger. This cluster was observed using the MWA as part of the GLEAM survey. The data from the GLEAM survey at multiple frequencies (88, 118, 154, 215 MHz) were analysed and imaged using the CASA software. We were able to detect both the relics at all the frequencies. At 150 MHz we achieved a resolution of 3′×3′ and an RMS of 15 mJy/beam. The spectral indices of the eastern and western relic were estimated to be −1.44±0.13 and −1.16±0.08 respectively. Although no central halo was detected we were able to put a stringent upper limit on the radio power from any possible radio halo. This limit is a factor of 10 lower than any existing limits. The results and implications of these observations will be presented

EA-20	ASI2015_580	BISWAJIT BANERJEE	Poster

Pratik Majumdar. Saha Institute of Nuclear Physics, Kolkata.

Fermi-LAT analysis of the variable source Mrk 421 from 2009 till 2010.

We present the result of detection of high energy flare from Mrk-421, using the data of the Large Array Telescope(LAT) on board the Fermi observatory. The analysis is done with 9 month (from October-2009 to June-2010, in the energy range 300 MeV to 100GeV) LAT data of the above Active galactic nucleus (AGN) by using Fermi analysis tools. Flux variability with flux-doubling time of the order of minutes was observed during the most active month February-2010. Two additional flares from the same source are also observed in this campaign during December 2009 and April 2010. The timming parameters of the flares which are associated with several physical quantities like acceleration and deceleration of the blob etc. will also be presented.

EA-21	ASI2015_581	mousumi das	Poster

Chandreyee Sengupta (Korea Astronomy and Space Science Institue, Korea), M.Honey (Indian Insitute of Astrophysics)

The Dark Matter Content of the Bulgeless Galaxies NGC4701 and NGC4775 and its Implications for Disk Evolution

We present GMRT HI imaging and HCT optical observations of two bulgeless spiral galaxies NGC4701 and NGC4775. Both galaxies are close to face-on and nearly pure disk in morphology. NGC4701 is a small low surface brightness galaxy wih a very extended HI gas disk and NGC 4775 is a gas rich dwarf. We used our HI maps to derive the dark matter content of both galaxies in order to understand the role of the dark halo in limiting bulge formation in disk galaxies. Our results show that NGC4701 is a halo dominated galaxy whereas NGC4775 has comparable stellar and halo masses. We also contrast the nuclear and disk properties of both galaxies. Our findings suggest that although the dark matter halo is important for inhibiting star formation in spirals, it is not important for slowing down the formation of bulges in pure disk galaxies. We discuss the implications of our results for the formation and evolution of these systems.

EA-22	ASI2015_582	Rahna P T	Poster

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Analysis of SEDs of dust lane spheroidal galaxies using CIGALE

Understanding the origin and evolution of galaxies is one of the most important ongoing problem in recent years and lot of efforts being put-in by several researchers in this direction. We present a detailed model based analysis of spheroidal galaxies with prominent dust lanes (DLSGs) using the data released from some of most important all sky multiwavelength surveys (FIRST, IRAS, SDSS and GALEX). We use data of sample of 362 DLSGs, ranging from redshifts of z = 0.01 to 0.07 to fit the spectral energy distribution (SED) using CIGALE. CIGALE, a code developed by Laboratoire d'Astrophysique de Marseille, is a best tool to derive the properties of galaxies by fitting SEDs of galaxies from the rest frame far UV to far IR wavelength. Using bayesian analysis the code determines parameters such as mass of the galaxy, D4000 break, bolometric luminosity, dust luminosity, ages of young, old stellar population, star formation rate, dust attenuation. Analysis of the SEDs of the galaxies should therefore, in principle, allow us to completely understand the properties of DSLGs.

EA-23	ASI2015_586	Sonali Sachdeva	Poster

Dimitri Gadotti (ESO, Chile), Kanak Saha (IUCAA, India)

Evolution of bulges in disc galaxies

Establishing the relative role of internally and externally driven mechanisms responsible for bulge growth is essential to understand disc evolution. To achieve that, we have studied the evolution in the inner-region of disc galaxies without classical bulge in comparison to those with that for z<1. Using images from Hubble Space Telescope and Sloan Digital Sky Survey, we have computed both parametric and nonparametric measures and examined the evolution in size, inner concentration, stellar mass, stellar density inside effective radius and asymmetry. Both disc galaxies with and without classical bulge have gained more than 50% of their mass since z~0.9. The size evolution as well as the strengthening of the bulge component with time is more effective for the galaxies with classical bulge. However, the fall in asymmetry is more drastic for the bulgeless disc sample. Overall, we infer that the externally driven evolution in terms of accretion and minor-mergers is more dominant than secular evolution. Also, the local environment of the galaxy is seen to play a significant role in its structural evolution.

EA-24	ASI2015_598	Sheelu Abraham	Poster

Ninan Sajeeth Philip, St. Thomas College, Kozhencheri, Kerala

Photometric Redshifts of Quasars from SDSS

With the availability of large volume of astronomical data with unconfirmed nature, the accurate photometric classification and redshift estimations are still remaining as major challenges in the observational astronomy. The best way to find the redshift of an astronomical source is to take its spectrum. However, there are situations where the spectroscopic estimation becomes impossible due to poor signal-to-noise ratio, instrumental systematics or that the brightness of the object under study is fainter than the spectroscopic limit. Moreover, given the large number of objects, it is necessary to have some prior knowledge that would help one to shortlist the interesting objects for spectroscopic observations. We therefore address the problem of photometric redshifts of unresolved point sources, especially quasars, using photometric colour information from Sloan Digital Sky Survey (SDSS). SDSS was chosen because it was primarily designed to track quasars. In the present study, we have used the DBNN Bayesian classifier for the estimation of the photometric redshifts of quasars using 10 colours and one magnitude from SDSS as the input features. There are ~158,165 known quasars which span the redshift range 0 to 7 in SDSS i - band magnitudes brighter than 23. We report the accuracy of the predictions within different error bars and identify the colour regions as a function of predictability confidence. The poster presentation shall cover the major findings of this work.

EA-25	ASI2015_607	Savithri H. Ezhikode	Poster

Gulab Chand Dewangan, IUCAA, Pune Ranjeev Misra, IUCAA, Pune, Shruti Tripathi, IUCAA, Pune and Ninan Sajeeth Philip, St. Thomas College, Kozhencherry, Kerala

UV and X-ray Correlations of the NLS1 galaxy Ark 564

The optical/UV and X-ray variability in AGNs and their interrelationship is an unclear issue till date. It is debatable that the X-ray variability arises due to the optical/UV flux variations or the latter originates from the reprocessing of X-rays. In the first case, the disc flux is expected to vary with variations in the accretion rate ($\dot{M}$) and so does the X-ray spectrum. We address this problem by studying the UV and X-ray correlation of Arakelian 564 (Ark 564) using the simultaneous X-ray and UV data available from XMM-Newton. Ark 564 is one of the brightest sources among Narrow-Line Seyfert 1 (NLS1) galaxies which accretes at Super-Eddington rate. We describe the soft and hard X-ray spectra of this source by Comptonization models, assuming a geometry of `two-component corona' coupled to the accretion disc. The geometry suggests a steepening of high energy spectrum with an increase in the soft X-ray flux and therefore due to an increase in the accretion rate. We confirm this by finding that the high energy photon index (Γ) and the scattered fraction (f_{sc}) of photons from the cool, optically thick corona to the optically thin, hot corona are well correlated with the Eddington ratio ($\dot{m}=\dot{M}/\dot{M_{Edd}}$) and soft and hard X-ray luminosities relative to the Eddington value (L_{soft}/L_{Edd} and L_{hard}/L_{Edd} respectively). We also find positive correlations between Γ and f_{sc}, L_{hard}/L_{Edd} and L_{soft}/L_{Edd} and L_{soft}/L_{Edd} and $\dot{m}$, whereas L_{hard}/L_{Edd} and $\dot{m}$ show poor correlation.

EA-26	ASI2015_622	Veeresh Singh	Poster

Ishwara-Chandra C.H. (National Centre for Radio Astrophysics, TIFR, Pune), Yogesh Wadadekar (National Centre for Radio Astrophysics, TIFR, Pune), Jonathan Sievers (Astrophysics and Cosmology Research Unit, UKZN, South Africa), Alexandre Beelen (Institute d'Astrophysique Spatiale, Orsay, France)

Rare examples of radio galaxies hosted in spiral-like hosts

Radio galaxies in the local universe are found to be exclusively hosted in massive elliptical galaxies characterized by relatively rarer Inter-Stellar Medium (ISM) and feeble star formation. This property of radio galaxies is reconciled by considering feedback processes involving the interaction of large and fast jets with the ISM. We report the discovery of three extremely rare examples of radio galaxies with spiral-like hosts using optical data from the SDSS survey in combination with FIRST and NVSS radio surveys. The host galaxies of these sources appear to have morphology, star formation efficiency and dust content similar to normal star forming disk galaxies. Our analysis on the formation of these systems favors the plausible scenario of a merger or a strongly interacting system residing in an over-dense region.

EA-27	ASI2015_652	Subhash Bose	Poster

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Optical characterization of supernova 2013ej

We present optical observations collected primarily from Indian observatories for a type IIP supernova (SN) 2013ej. It is one of the brightest and nearest supernova of the year 2013, and thus making it one of the most interesting object for in-depth analysis. Broadband UBVRI photometric and low-resolution optical spectroscopic data is presented and analysed. Using NaID lines as a probe for reddening determination from high resolution Echelle spectrum obtained during plateau-nebular transition phase, we infer that the SN suffers very low or negligible line-of-sight extragalactic extinction as no NaID impression for host is found in the spectrum, thus only we accounted for galactic extinction. The absolute and bolometric light-curve comparison suggest it to be a normal IIP SN, but with relatively steeper plateau decline rate (~ 1.83 mag/100days in V band) as compared to other canonical IIP events. The luminosity drop from plateau to nebular transition is also found to quite higher than other typical events (~0.88 dex) which also implies relatively low synthesized radioactive nickel mass estimation from tail luminosity, which is 0.023 M_sun. In this study we shall also present velocity evolution of H_alpha, H_beta and FeII lines, and it’s comparison with other archetypal events.

EA-28	ASI2015_658	Pallavi Bhat	Poster

Prof. Kandaswamy Subramanian, IUCAA

Fluctuation dynamos: theory, simulations and observational consequences.

Turbulence is ubiquitous in many astrophysical systems like galaxies, galaxy clusters and possibly even the filaments in the intergalactic medium. Such turbulent systems host fluctuation dynamos which operate on minimal requirements of the underlying flow, and lead to the exponential growth of magnetic fields on the short eddy turn over time-scales. A random flow with modest magnetic Reynolds number $\Rm\sim 100$ is sufficient to activate the fluctuation dynamo. The only analytical model of the fluctuation dynamo is the Kazantsev model which assumes a velocity field that is delta-correlated in time. We generalize the analytic model of fluctuation dynamo to include the effects of a finite correlation time, τ, using renewing flows. We show, an intriguing result, that to the leading order in τ, the magnetic power spectrum, preserves the Kazantsev form, $M(k) \propto k^{3/2}$, in the large k limit, independent of τ. Such a spectrum peaks at large k, thus concentrating most of the magnetic energy at resistive scales. But as the fluctuation dynamo saturates, the Lorentz force tends to shift the energy to larger scales. In order to study this nonlinear evolution, we have studied periodic box simulations of the fluctuation dynamo of high resolution up to 512^3 and measure the resulting random Faraday rotation measure (RM). We show that when the dynamo saturates, the rms value of RM is of the order of 40–50 per cent of the value expected in a model where fields of strength Brms uniformly fill cells of the largest turbulent eddy but are randomly oriented from one cell to another. We also show that the magnetic integral scale, Lint, which is directly related to the RM dispersion, increases as the dynamo saturates. It appears that due to the ordering effect of the Lorentz forces, Lint of the saturated field tends to a modest fraction, 1/3–1/4 of the integral scale of the velocity field, for all our runs with varying $\Rm$. These results are then applied to discuss the Faraday rotation signatures of fluctuation dynamo generated fields in young galaxies, galaxy clusters and intergalactic filaments.

EA-29	ASI2015_662	Kartick Chandra Sarkar	Poster

1) Biman B. Nath, Raman Research Institute, Bangalore. 2) Prateek Sharma, Indian Institute of Science, Bangalore. 3) Yuri Shchekinov, Southern Federal University, Rostov-on-Don, Russia

Effect of hot halo gas on supernovae driven outflows

Galactic outflows are understood to be crucial in galaxy formation theory and enrichment of the intergalactic medium (IGM). We have studied the effect of the often-neglected hot halo gas on supernova driven outflows from Milky Way (MW) type galaxies. Based on hydrodynamic simulations, we relate the mass loss rates, at different radii and times, with the central star formation rate (SFR). We find that the time averaged mass loss rate at the virial radius scales roughly linearly with the SFR ($\dot{M} \propto {\rm SFR}^{0.85}$). The temperature distribution of the outflowing material within 10 kpc is found to be bimodal in nature, peaking at 10^5 K and $10^{6.5}$ K, responsible for optical and X-ray emission. We show that the warm ($T < 10^{5.5}$ K) mass loading factor (η_{3e5}=mass outflow rate/SFR, commonly used in observations) can be connected to the mass loading factor at the virial radius (η_v) as $\eta_v \sim 2 \times \eta_{3e5}$. This link between observed outflow rate at inner region and expected rate at the virial radius is important for cosmological simulations which do not resolve galaxies and depend on feedback prescriptions.

EA-30	ASI2015_677	Prakriti Pal Choudhury	Poster

Prateek Sharma Indian Institute of Science, Bangalore

Numerical global eigenmode analysis of thermal instability in the intracluster medium

Numerical simulations of thermal instability in hydrostatic and thermal equilibrium have shown that the local thermal instability leads to multiphase gas if the background cooling time is sufficiently short. Cartesian, plane-parallel simulations show that cold gas condenses out of the hot phase, starting from small perturbations, if the ratio of the local cooling time to the local free-fall time (tcool /tff) is less than 1. The same setup in spherical geometry, and with background profiles similar to cluster cores, shows that cold gas condenses if this critical ratio is less than 10; i.e., it is much easier for cold gas to condense out in a spherical system. This tcool /tff ∼ 10 threshold explains the tight correlation between the presence of extended cold (104 K) gas and the core entropy of the X-ray gas (107 K). We perform a numerical global eigenmode analysis of thermal instability in spherical and Cartesian geometries in order to understand this important geometrical effect.

EA-31	ASI2015_687	Prathamesh Tamhane	Poster

Yogesh Wadadekar, NCRA-TIFR, Pune, India. Veeresh Singh, University of KwaZulu-Natal, South Africa. Ishwara Chandra, NCRA-TIFR, Pune, India. Aritra Basu, Max-Planck-Institut für Radioastronomie, Germany. Alexandre Beelen, Institut d'Astrophysique Spatiale, France.

Extended diffuse X-ray emission associated with lobes of a high redshift giant radio galaxy

We investigate the nature of extended, diffuse, X-ray emission associated with the lobes of a giant radio galaxy at redshift z=1.325, in the XMMLSS field using XMM-Newton observations. X-ray emission is nearly co-spatial with the radio lobes and 0.5 - 10 keV spectrum can be best fitted with a power law of index ~ 1.6, consistent with its plausible origin as Inverse Compton scattering of the Cosmic Microwave Background (ICCMB) photons. We estimate the magnetic field in radio lobes using both X-ray and radio observations. We find that the magnetic field estimates assuming ICCMB and equipartition argument are 12.5 $\micro$G and 8.2 $\micro$G, respectively, consistent with each other within the uncertainties. Our estimate of total energy in relativistic particles within the lobes (6.7×10^{59} erg.) implies a significant impact of lobes into the surrounding medium. Notably, radio and X-ray emission from the central AGN remains undetected in present observations inferring AGN to be either in an intrinsically weak phase or heavily absorbed with flat/inverted radio spectrum. Our study of this source will be presented in the context of evolution of radio galaxies.

EA-32	ASI2015_689	Arunima Banerjee	Poster

Chanda J. Jog, IISc, Bangalore

A tilted dark matter halo: Signatures on the HI Rotation Curve and Scaleheight Data

The HI rotation curve and scaleheight data constitute a valuable tracer of the shape and the density profile of the dark matter halo. Conventionally the dark matter halo is modeled to be oblate or prolate in shape with its symmetry axis aligned with that of the galactic disk. However recent N body simualtion studies of galaxy formation have indicated that the symmetry axis of the galactic disk may lie off the principal planes of the dark matter halo. In other words, the symmetry axis of the dark matter halo may remain tilted with respect to that of the disk. In this paper, we study the effect of such a tilted dark matter halo on the observed HI rotation curve and scaleheight data.

EA-33	ASI2015_691	RULEE BARUAH	Poster

Kalpana Duorah, H. L. Duorah Deptt. of Physics, Gauhati University

BETA DECAY RATES OF SUPERHEAVY ELEMENTS IN EXPLOSIVE ASTROPHYSICAL ENVIRONMENT

Stars in the mass range 10-30 M⊙ evolve to form iron cores of 1.3 to 1.6 M⊙. These iron cores collapse according to well known instabilities, photodisintegration and electron capture. During collapse an outward bound shock wave forms in the matter falling onto the nearly stationary core. The conditions behind the shock at 100 to 200 km are suitable for neutrino heating . This neutrino heating blows a hot bubble above the protoneutron star and is the most important source of energy for Supernova Explosion . Here we try to attain the r-process (rapid neutron capture process) path responsible for the production of superheavy elements beyond iron , which are otherwise not possible to be formed by fusion reactions . Astrophysical parameters needed for our analysis are temperature (> 109 degrees K) and neutron number density which we take to be greater than 1020 cm-3. In the later expansion stages after SN explosion where the neutron density supposedly falls, the r-process nucleosynthesis produces the heavy elements which subsequently beta decays and the r-process path forms. Along the path , the experimental data of observed elements matches our calculated ones. Later ejecta are neutron-rich (Ye < 0.5) and leaves behind a compact neutron star . We note that the element 98Cf 254 shown by the SN light curves is found in our classical astrophysical condition of T = 1.9× 109 K and nn = 1020 cm-3. Also we note an element of mass 273 corresponding to atomic number 115, at temperature 3.0 × 109 K and neutron density 1020 cm−3. The decay rates of these elements are found to be very much higher than their electron capture rates. KEYWORDS : R-process, nucleosysthesis, interstellar medium.

EA-34	ASI2015_694	ADITI AGARWAL	Poster

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Multi-band Radio Cross-correlated Variability of the Blazar 3C 454.3

Core-jet structure is one of the salient features of radio-loud active galactic nuclei (RLAGN) and specifically in Blazars. We will present multi-band cross correlation for the Blazar 3C 454.3 in the five radio bands from 4 GHz to 37 GHz using the combined ~ 4 decades data taken from radio telescopes of University of Michigan Radio Astronomy Observatory, Cremia Observatory, and Metsahovi Radio Observatory. We have calculated frequency dependent time delays using multiple Gaussian model fitting to the multi-frequency light curves. Using these time lags of the different flares, we estimated frequency-dependent core shifts in 3C 454.3 and a radiative shock model, we have derived physical parameters of the jets such as magnetic field strength in the core region, core position offset, and distance between the core and the base of the jet.

EA-35	ASI2015_713	Nagamani P.	Poster

P Nagamani^1 Priya Hasan^2 and S N Hasan^3 1. Department of Astronomy, Osmania University, Hyderabad. 2. Department of Physics, MJCET, Hyderabad 3. Department of Mathematics, MANUU, Hyderabad.

"Luminosity Decomposition profiles of pairs of spiral galaxies"

Abstract: In this paper we discuss the GALFIT technique, its caveats and its analysis. Using GALFIT we decompose the luminosity profiles of pairs of spiral galaxies to derive there parameters and using data from 2MASS, WISE, SDSS & HST we explore interactions and possible mergers.

EA-36	ASI2015_716	Vaidehi S. Paliya	Poster

C. S. Stalin, Indian Institute of Astrophysics

Blazars in the Early Universe

Blazars are radio-loud active galactic nuclei with powerful relativistic jets oriented at small angles to the observer. As as result, the radiation from blazars is strongly Doppler boosted and they are therefore expected to be visible to very high redshifts ($z > 4$). Such high redshift blazars are found to be hosted by more than a billion solar mass black holes (BH). Searches for high redshift blazars is extremely important as every new detection of a high redshift blazar implies the existence of hundreds of such high BH mass systems with jet pointing elsewhere. This has major implications on BH formation models. We have carried out a systematic search for high redshift radio-loud quasars (RLQs) from SDSS-DR10. The sample thus obtained is carefully analysed using all available archival observations from low-frequency radio waves to high-frequency X-rays. In the analysis, we have concentrated on two properties of the RLQs, namely high radio-loudness and high X-ray flux with a hard spectrum. The RLQs found with large radio-loudness and hard X-ray spectrum were then subjected to multi-band SED modeling to identify candidate high redshift blazars. This effort has led to the identification of about half-a-dozen potential high redshift blazar candidates. The details of the findings will be presented.

EA-37	ASI2015_724	Shubham Srivastav	Poster

J. P. Ninan (TIFR) G. C. Anupama (IIA) D. K. Sahu (IIA) D. K. Ojha (TIFR)

Optical and NIR observations of nearby supernova SN 2014J

We present optical and NIR observations of the type Ia supernova SN 2014J, hosted by the nearby galaxy M82. The photospheric velocity near the epoch of B-band maximum, deduced using the Si II 6355 feature is $\sim$ 12000 km/sec, which is at the border of spectroscopically normal and High Velocity (HV) SNe Ia. NIR spectra obtained near B-band maximum show broad features due to Mg II near 1.1 microns and Si II/ Mg II blend near 1.6 micron. The spectra, along with the bolometric light curve constructed using broadband magnitudes spanning UV to NIR, suggest that SN 2014J is essentially a normal, albeit a highly reddened type Ia supernova, with a decline rate parameter of $\Delta m_{15} \sim 1.1$ in the B-band and a ^{56}Ni yield of ~ 0.6 M$_{\odot}$.

EA-38	ASI2015_750	Arun Mangalam	Poster

Prashanth Mohan (ARIES)

Relativistic Signatures in emission from inner regions of Black hole and neutron star systems

We present a general relativistic model of motion of an emitting particle in motion in Schwarzschild geometry which include Doppler and gravitational shifts, aberration, light bending and time delay. This formalism has applications to two situations: (i) jet based variability in active galactic nuclei due to an orbiting blob in helical motion along a funnel or cone shaped magnetic surface anchored to the accretion disk close to the black hole and (ii) emission from a hot spot on an X-ray Pulsar. Both these effects have observable consequences on the light curves from these objects. In the case of AGN, the simulated LCs are used to study quasi-periodic oscillations (QPOs) and the power spectral density (PSD) shape. These results strongly justify the use of a realistic magnetic surface geometry and a GR framework to describe effects on emission from orbital features in the jet, especially for launch radii close to the horizon radius. A power law shaped PSD with a typical slope of -2 and QPOs with timescales in the range (1.37 - 130.7) days consistent with optical variability in Blazars, emerge from the simulations for black hole masses $M_\bullet= (0.5--5) 10^8 M_\odot$ and initial blob Lorentz factors jet $\simeq 2-10$. In second case of pulse profiles from X-ray pulsar, the mass and radius can be extracted from several constraints that can be placed using the pulse profiles.

EA-39	ASI2015_767	C S Stalin	Poster

C. S. Stalin & Vaidehi S. Paliya

Narrow line Seyfert 1 galaxies: a new class of gamma-ray emitting AGN

The launch of the Fermi gamma-ray space telescope in the year 2008 has led to the discovery of gamma-ray emission from more than thousands of celestial sources based on the first two years of its operation. Considering only the extragalactic sky, blazars dominate the population of gamma-ray emitting sources. Prior to Fermi, only two classes of gamma-ray emitting AGN were known, namely radio galaxies and quasars. However, since the launch of Fermi, gamma-ray emission has also been detected in a total of five Narrow line Seyfert 1 (NLSy1) galaxies, which clearly demonstrates the existence of a third class of gamma-ray emitting AGN. The detection of gamma-rays from NLSy1 galaxies have established beyond doubt the presence of relativistic jets in these sources. However, it is generally thought that NLSy1 galaxies are hosted by spiral galaxies, and if it is true, then spiral galaxies can also launch relativistic jets. We have carried out a systematic study of these newly discovered gamma-ray emitting NLSy1 galaxies, using data in the optical from HCT, UV and X-rays from Swift/UVOT, Swift/XRT and Swift/BAT, and gamma-rays from Fermi. We have found that these new gamma-ray emitting NLSy1 galaxies have properties similar to the Flat Spectrum Radio Quasar (FSRQ) category of AGN. However, we find one of the gamma-ray emitting NLSy1 galaxies to have both the characteristics of a Seyfert galaxy and a FSRQ.

EA-40	ASI2015_770	Navpreet Kaur	Poster

Navpreet Kaur(PRL), K. S. Baliyan(PRL), Sunil Chandra(PRL, currently in TIFR), Shashikiran Ganesh(PRL), Pankaj Kushwaha(TIFR), Kumar Venkataramani(PRL)

Spectral Modeling of blazar CGRaBS J0211+1051

CGRaBS J0211+1051 was seen in high state at γ-rays (>0.1 GeV) during 2011 January 25-31. A detailed study of polarization behavior of this object was carried out by Chandra et 2011 (ApJ,746,92). The fast intranight variations with high flux state at other wavelengths confirm the emission to be originated from relativistic jet. This object has mostly been in fainter state and hence very few studies are available in literature. Based on polarization behavior of this object, it was claimed to belong to Low Frequecy BL Lac Object (LBL) class, a sequence in blazars. Using a more detailed observations and multi-wavelength techniques this object was again studied for confirming it's classification (Chandra et al 2014, ApJ 791,85). The Spectral Energy Distribution (SED) clearly confirms the LBL classification of this object. The significant variability at all frequencies are seen which may introduce the shift of peak of SED and hence uncertainty in classification. This led us to perform the SED modeling of this object. In this paper, we will discuss few of the interesting results obtained from modeling for example, the nature and origin of high energy emission.

EA-41	ASI2015_777	NAVEEL AHMAD WANI	Poster

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Global Time Dependent Solutions Of Stochastically Driven Standard Accretion Disks: Development Of Hydrodynamical Code

X-ray binaries are powered by accretion disks around compact objects, where the X-rays are emit- ted from the inner regions while UV emission could arise from the relatively cooler outer parts. There is now increasing evidence that the variability of the X-rays in different timescales is caused by stochastic fluctuations in the accretion disk at different radii. These fluctuations which arise in the outer parts of the disk, propagate inwards to give rise to X-ray variability and hence this model provides a natural connection between the X-ray and UV variability. While there are analytical expressions to qualitatively understand the effect of these stochastic variabilities, quantitative predictions are only possible by a detailed hydrodynamical study of the global time dependent stan- dard accretion solution. For completeness, the study should include the unstable radiation pressure dominated inner disk, the outer regions which may be electron or free-free scattering dominated, the effect of the last stable orbit and the possibility of the dissipated energy being advected to smaller radii. We have started the development of a numerically efficient code to incorporate these effects. The code presently considers gas pressure dominated solutions with the boundary effect of the last stable orbit included. It has been tested for numerical stability.

EA-42	ASI2015_824	Dhanya Joseph	Poster

Ravikumar C. D., Preetha A. U and Aswathy S Department of Physics,University of Calicut,Kerala

Structural studies of early-type galaxies

We present a quantitative analysis of nearby ($z<0.018$) early type galaxies containing ionised gas observed in near infrared wavelengths (2MASS). Our sample contains 54 early type galaxies selected mainly from low density environments. From the two dimensional bulge disc decomposition anaysis using GALFIT, we extracted the structural parameters bulge and disc modelled by sersic and exponential functions. Most of our samples including ellipticals are disc dominant in nature.The average value of bulge to total luminosity(B/T) of our sample is 0.324. Low values of sèrsic index ($n<2$) also suggest the possibility of the presence of discs in our sample. The strong correlation between the half light radius (Re)and the disc scale length(Rd) indicates the formation of the bulges from already existing discs. The linear correlation coefficient of Re - Rd relation for our sample is 0.947 with a significance greater than 99.9%.

EA-43	ASI2015_845	Aswathy S	Poster

Ravikumar C D, Jithesh V, Preetha A U and Dhanya Joseph Department of Physics, University of Calicut

Analysis of optical counterparts of X-ray point sources in early type galaxies

Unresolved stellar populations in nearby galaxies contain valuable information regarding the formation of the galaxies. Many of such luminous point sources are detected to be brighter X-ray sources including ultra luminous X-ray sources (ULXs). We perform the optical analysis of the counterparts of X-ray point sources in a number of early type galaxies with an aim to investigate their X-ray to optical association. Our sample includes the galaxies NGC 1399, NGC 4649 and NGC 4552. We observe a strong anti-correlation with a high significance between the optical colours and X-ray luminosities excepting the ULXs included in the sample. As the optical counterparts are definitely multiple sources (most likely globular clusters), the strong trend exhibited by X-ray sources suggests the possibility of existence of multiple sources for the production of X-rays as well. Finally, we attempt to explain the correlation with the help of stellar population synthesis analysis.

EA-44	ASI2015_864	BARI	Poster

Bari Maqbool,Ranjeev Misra, Naseer Iqbal

The Effect of X-ray Irradiation on the Time Dependent behavior of Accretion Disks with Stochastic Perturbations.

The UV emission from X-ray binaries, may arise from the outer regions of an accretion disk. The structure of the outer disk may be altered due to the presence of X-ray irradiation and we discuss the physical regimes where this may occur and point out certain X-ray binaries where this effect may be important. The long term X-ray variability of these sources is believed to be due stochastic fluctuations in the outer disk, which propagate inwards giving rise to accretion rate variation in the X-ray producing inner regions. The X-ray variation will induce structural variations in the outer disk which in turn may affect the inner accretion rate. To understand the qualitative behavior of the disk in such a scenario, we adopt simplistic assumptions that the disk is fully ionized and is not warped. We develop and use a time dependent global hydrodynamical code to study the effect of a sinusoidal accretion rate perturbation introduced as a specific radius. The response of the disk, especially the inner accretion rate, to such perturbations at different radii and with different time periods is quantified. While we didn't find any oscillatory or limit cycle behavior, our results show irradiation enhances the X-ray variability at time-scales corresponding to the viscous time-scales of the irradiated disk.

EA-45	ASI2015_892	Resmi Lekshmi	Poster

Kuntal Misra Aryabhatta Institute of Observational Sciences Nainital, Uttarakhand

Multiband modeling of GRB081007 afterglow

Gamma Ray Burst 081007 is detected by Swift. The burst shows bright optical flashes and signature of associated supernova (SN 2008hw). We present a detailed multi-wavelength modeling of the afterglow from X-ray, optical to radio based on the standard internal-external shock model.

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ASI-2015 Poster Presentations

Instrumentation and Techniques

IT-1	ASI2015_404	Neha Sharma	Poster

Maheswar Gopinathan (Aryabhatta Research Institute of Observational Sciences, Nainital)

Preliminary optical design of Wi-Fi Pol (Wide Field Polarimeter) for 1.3m Telescope.

Preliminary optical design of Wi-Fi Pol (Wide Field Polarimeter) for 1.3m Devasthal optical telescope is presented. We have designed this polarimeter from optical to near infrared (NIR) region. The wavelength range from 0.45 micron – 1.4 micron has chosen. The polarimeter uses the beam-exchange technique, in which the two orthogonal polarization states are imaged simultaneously and a polarization modulator swaps the polarization states of the two beams before the next image is taken. The parameters of design have been optimized using an optical design software ZEMAX.

IT-2	ASI2015_464	Prasanna Deshmukh	Poster

Padmakar Parihar, Indian Institute of Astrophysics, Bangalore. Karthik AB, Christ University, Bangalore.

Dynamic loading assembly for performance testing of Segmented Mirror Telescope Actuators.

Upcoming Extremely large telescopes are 20-40 meter class and are based on segmented mirror technology. Hexagonal Segments in the range of 1 meter size placed side by side forms the monolithic surface and need to be maintained against external disturbances like wind, gravity, temperature and structural vibration. This is achieved by using three position actuators per segment working at few nanometer scale range along with a closed loop controller. The actuator along with a controller is required to meet very stringent performance requirements, such as track rates up to 300 nm/sec with tracking errors less than 4.4nm, dynamical forces of up to +/-40 N, ability to reject disturbances introduced by wind as well as by mechanical vibration generated in the mirror cell etc. Actuators required for upcoming segmented mirror telescopes (SMT) like TMT and E-ELT are being developed and required to go through various performance tests. In order to conduct these performance tests in more realistic conditions, we have designed and developed a Dynamic Loading Assembly (DLA) at ITCC Laboratory of Indian Institute of Astrophysics, Bangalore. Our DLA is a computer controlled force inducing device designed in a modular fashion to ease the design of experiment and can generate different type of user defined disturbances in extremely smooth and controlled manner. A simple spring-mass-damper based mathematical model developed by us, helped to ensure that the concept will work. Then after a detailed mechanical design work was undertaken, by making use of SolidWorks software and components were manufactured in IIA workshop. DLA have static and dynamic loading capability up to 250N and 18N respectively, with the bandwidth greater than 10 Hz. In this paper we will discuss various performance requirements of a SMT Actuator and our efforts to develop DLA at ITCC Laboratory of Indian Institute of Astrophysics, Bangalore. We will also discuss different test results obtained using DLA and a prototype actuator, developed for the Thirty Meter Telescope project.

IT-3	ASI2015_471	Kishore	Poster

Ramesh R, Kathiravan C & Rajalingam M

A low frequency radio spectropolarimeter for observations of the solar corona

A new spectropolarimeter for dedicated ground based observations of the radio emission from the solar corona at low frequencies ($<$ 100 MHz) has been recently commissioned at the Gauribidanur radio observatory near Bangalore. We report the observational setup, the calibration scheme, initial results on the observations of circularly polarized radio emission associated with weak solar transients and the related coronal magnetic field strength (B).

IT-4	ASI2015_501	satya ranjan behera	Poster

B. Raghavendra Prasad, IIA

Performance analysis of wavefront compensation at various light intensity and noise level condition in an closed loop Adaptive Optics system

For implementation of Adaptive Optics technique, a laboratory setup is essential to evaluate schemes and principles. Each and every component needs to be studied and evaluated experimentally in order to predict the performance of the Adaptive Optics system. The wavefront of the light is determined using wavefront sensor and reconstruction algorithms. This is compensated by using deformable mirror. In this paper, the results of study of reconstruction of wavefronts at various light intensity levels with noise like photon noise, background noise and readout noise is presented. Various centroiding methods like CoG, WCoG and cross correlation are compared with varying noise and light intensity levels. The input and output wavefront accuracy is measured at different intensity and noise levels.

IT-5	ASI2015_524	Ashutosh Bajpai	Poster

Sanket Kotak (TIFR Mumbai) Kallol Mukerjee (TIFR Mumbai) Irfan Mirza (TIFR Mumbai) K P Singh (TIFR Mumbai)

Bias estimation technique used for X-ray CCD of Soft X-ray telescope

There has been a remarkable progress in enhancing the technologies of X-ray charge coupled devices (CCD) over the years and is proven to be efficient and reliable for astronomical applications. The pixel Bias is a constant offset of individual pixel of the CCD dark frames which set-in and vary depending on operational conditions and space environment which is very crucial for accurate measurements. The technique of Bias determination in-flight has been a real challenge for an accurate measurements using X-ray CCD. Significant improvements were made over the period in the bias measurement technique and applied for data correction to several X-ray missions. An application of a Bias determination technique depends also on dynamic conditions of a particular mission and factors such as on-board hardware and data processing capabilities. This paper presents a bias estimation technique suitable for Soft X-ray Telescope (SXT) of Indian Astronomical satellite mission ASTROSAT to be launched in near future. There are many data read out modes in SXT, designed to optimize the astronomical observations. This work presents a comprehensive study and analysis of science data acquired through flight module of the telescope as part of ground calibration, considering individual modes and their limitations and determination of appropriate CCD bias for SXT. This bias estimation technique accounts for spatial, temporal and temperature dependent variation and tested on different modes of data acquired at different temperatures. Results are encouraging and hence this technique is adopted in the data processing chain for extracting scientific data products from the telescope.

IT-6	ASI2015_538	Avinash Surendran	Poster

A. N. Ramaprakash, IUCAA Mahesh P. Burse, IUCAA

Development of a Scalable Generic Platform for Adaptive Optics Real Time Control

ABSTRACT The main objective of the present project is to explore the viability of an adaptive optics control system based exclusively on FPGAs, making strong use of their parallel processing capability. In an Adaptive Optics system, the generation of the Deformable Mirror (DM) control voltages from the Wavefront Sensor (WFS) measurements is usually through the multiplication of the wavefront slopes with a predetermined Reconstructor matrix. The ability to access several hundred hard multipliers and memories concurrently allows performance far beyond that of a modern CPU or GPU for tasks with a well defined structure such as Adaptive Optics control. The target of the current project is to generate a signal for a real time wavefront correction, from the signals coming from a Wavefront Sensor, wherein the system would be flexible to accommodate all the current Wavefront Sensing techniques and also the different methods which are used for wavefront compensation. The system should also accommodate for different data transmission protocols (like Ethernet, USB, IEEE 1394 etc.) for transmitting data to and from the FPGA device, thus providing a more flexible platform for Adaptive Optics control. Preliminary Simulation Results for the formulation of the platform, and a design of a fully scalable slope computer will be presented. Some preliminary work regarding a scalable AO reconstructor will also be presented.

IT-7	ASI2015_545	Devraj Pawar	Poster

Kaustubh Vaghmare (IUCAA, Pune), Varun Bhalerao (IUCAA, Pune), Aditya Rotti (Florida State University, USA), Eric Bellm (Caltech, USA)

Optical Counterparts to ROSAT X-Ray Sources

The ROSAT Bright Source Catalog (BSC) consists of 18,806 objects discovered by the ROSAT satellite in its mission. Almost half of the sources are still unidentified owing to the large error circles from the ROSAT data. Past efforts have tried to associate optical counterparts to the sources by putting a cut on positional offset, and assigning the brightest object as the counterpart. More recent efforts have also investigated optical variability. We propose a method to robustly combine all information regarding positional offset, optical brightness and optical variability and assign association probabilities in order to securely identify optical counterparts. In this method, if 's' is the positional uncertainty in the X-ray source, all optical sources within 3s radius are considered as candidates. For each candidate, we assign a formal association probability based on offset, brightness and variability. For offset, a Gaussian distribution of errors is assumed while for brightness, a background brightness distribution is determined using a control field which comprises objects between 3s and 30s. To determine the association probability based on variability, we need to be able to determine the actual variability of the source over and above the measurement noise. We present a detailed theory of how this can computed and simulations to verify the same. The method is currently being used to find optical counterparts to ROSAT BSC X-ray sources using the light curves made available by the Palomar Transient Factory survey but can be employed to find counterparts to any sources discovered in any waveband with large positional uncertainties.

IT-8	ASI2015_554	Kishalay De	Poster

Yashwant Gupta (NCRA-TIFR, Pune)

A Real-time Coherent Dedispersion Pipeline for the GMRT

A fully real-time coherent dedispersion system has been developed for the pulsar back-end at the Giant Metrewave Radio Telescope (GMRT), Khodad. The dedispersion pipeline uses the phased array voltage beam mode of the existing GMRT software back-end (GSB) to produce coherently dedispersed intensity output in real time for the currently operational bandwidths of 16 MHz and 32 MHz. Provision has also been made to coherently dedisperse voltage beam data from observations recorded on disk. The high sensitivity of the GMRT at low frequencies, as well as its wide frequency coverage with reasonably large bandwidths makes it a powerful instrument for pulsar studies. However, pulsar observations at such low frequencies are distorted by the deleterious effects of dispersion and scattering, which can limit the utility of such an instrument. Despite incoherent dedispersion being an effective first step towards correction of dispersion, the inaccuracy of the technique is particularly evident in low frequency observations requiring high time resolution, such as for millisecond pulsar studies and observations of pulsar microstructure. The effects of interstellar dispersion can be completely removed using coherent dedispersion, which recovers the original voltage signal, as emitted at the pulsar, by a deconvolution operation on the voltage signal received at the telescope. However, this technique is computationally very expensive to implement, especially when required to be done at real-time rate. The recent emergence of parallel computing on GPUs has provided a powerful tool to overcome the computational challenges. With currently available GPUs and efficient FFT libraries, it is now feasible to implement real-time coherent dedispersion, followed by appropriate integration of the intensity data to reduce the load of writing data to a disk. In this paper, we describe the design and implementation of such a real-time coherent dedispersion system for the GMRT. Functioning on an Intel Xeon X5550 CPU equipped with a NVIDIA Tesla C2050 GPU, this pipeline now allows us to obtain dispersion free high time resolution data in real-time. We demonstrate the significant improvements over the existing incoherent dedispersion system at the GMRT. We describe the steps carried out to optimise the performance of the pipeline, and also present some interesting preliminary results obtained from studies of pulsars using this system. We also discuss possible growth and improvements for such a pipeline, including with respect to the upgraded GMRT which will have bandwidths about ten times larger than at present.

IT-9	ASI2015_555	Shilpa Shantaram Dubal	Poster

Sachin S. Sherkar, National Centre for Radio Astrophysics. Dharam Vir Lal, National Centre for Radio Astrophysics.

A Database of Phase Calibrators for the GMRT

The GMRT is the most sensitive radio telescope in the world operating at low radio frequencies. In order to obtain reliable information about the target astronomical sources, radio sources whose structure and flux density are known a-priori, are routinely observed to determine the antenna based calibration solutions. Any errors in the models used for these 'calibrator' sources reflect in errors in the antenna based calibration solutions, especially in the phase, and limit the quality of the radio images obtained. GMRT users have traditionally been using phase calibrators from the VLA calibrator list which is biased towards observing at higher frequencies. We are pursuing a project to build a database of phase calibrators suitable for the GMRT. In addition to their flux densities, this database will include models for calibrator sources, (u,v) plot, cleaned and restored maps, and clean-component lists. Here, we present the results for our sample of low frequency calibrators at frequencies 610 MHz and 235 MHz.

IT-10	ASI2015_556	Sachin Shankar Sherkar	Poster

Nilesh Sadashiv Raskar, National Centre for Radio Astrophysics (TIFR) Dharam Vir Lal, National Centre for Radio Astrophysics (TIFR)

Statistical testing of the long term stability of the new GMRT Wideband Backend

The GMRT is the world's most sensitive radio interferometer and is currently undergoing a very significant upgrade. One of the key objectives of this upgrade is to improve the sensitivity of observations by increasing the bandwidth of observations from the present 30 MHz to a target of 400 MHz. A new GMRT Wideband Backend (GWB) is being implemented to achieve this. In its present state of prototyping, the GWB accepts 8 inputs and can provide a bandwidth of 200 MHz. It supports the following three modes of observation: (a) 8 antenna, single polarisation Stokes I products (b) 4 antenna, dual polarisation, Stokes I products, and (c) 4 antenna, dual polarisation, full Stokes products. The end-to-end wideband signal chain is now available on 12 of the 30 GMRT antennas. The GWB has been in use since February 2014, and here we present a statistical, long term stability analysis of the new wideband systems spanning this period using the existing GMRT Software Backend (GSB) as a benchmark.

IT-11	ASI2015_577	Sabyasachi Chattopadhyay	Poster

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IFU Deployment Algorithm for 3.6m Devasthal Optical Telescope Integral Field Spectrograph

Devasthal Optical Telescope Integral Field Spectrograph (DOTIFS) is a new multi-object integral field spectrograph being built by the Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune, India for the 3.6m Devasthal Optical Telescope, (DOT). The Devasthal Observatory is being constructed by the Aryabhatta Research Institute of Observational Sciences (ARIES), Nainital. DOTIFS is mainly designed to study the physics and kinematics of ionized gas, star formation and H II regions in the nearby galaxies. DOTIFS is a novel instrument in terms of multi-IFUs, built in deployment system, and high throughput. A magnifier at the Cassegrain side port of the telescope feeds sixteen integral field units (IFUs). Each IFU is comprised of a microlens array and optical fibers offering 144 spaxels at a sampling of 0.8” per 300μm hexagonal microlens and a total field of view of 7.2” × 8.4”. The fibres feed eight identical spectrographs that will produce 2,304 spectra at R~1800, over a wavelength range of 370-740nm in a single exposure. The sampling scale can be changed by changing the magnifier and/or by dithered observations and proper data process. The IFUs can be deployed over an 8’ diameter focal plane by x-y actuators. An intelligent deployment algorithm has been developed to allow optimized reconfiguration and to avoid any collision between IFUs. The whole deployment system has a complex 3-dimensional structure to allow maximum positioning freedom to the IFUs. It has wide deployable area relative to each IFU’s field of view, and doesn’t require any direct human interaction for the deployment. This system is one of the big technical challenges of this project. In this poster we present the IFU deployment algorithm. The optical design of the magnifier, IFUs and the spectrographs has been completed. Observing techniques, data simulator and reduction software are also under development. The instrument is planned to be commissioned in late 2015.

IT-12	ASI2015_592	Girish B. S.	Poster

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A New Generation Digital Receiver for the Murchison Wide-field Array

The Murchison Wide field Array (MWA) is a low frequency interferometric radio telescope located in the Murchison region of Western Australia. The three key science projects of MWA are: 1) search for redshifted HI signals from the Epoch of Reionization (EoR); 2) wide-field searches for transient and variable objects; and 3) wide-field Galactic and extra-galactic surveys. The MWA is the only low frequency (80 - 300 MHz) Precursor for the Square Kilometre Array (SKA) and is the first of the three SKA Precursors to be fully operational for science (since July 2013). Currently, the MWA consortium is discussing the possibilities of upgrading the array to enhance its scientific productivity. In this presentation, we shall describe a proposal by the Raman Research Institute (RRI) for a new generation Digital Receiver System for phase 2 of MWA that exploits the rapid advances in the processing capabilities of modern FPGAs. The proposed receiver shall be capable of digitizing an analogue signal of bandwidth up to 500 MHz using a 10-bit analogue-to-digital converter (ADC). When compared with the existing receiver which is based on an 8-bit ADC, the proposed receiver provides increased headroom for better RFI management. While the data bandwidth of the existing receiver allows ~10% of the sampled bandwidth to be transported for further processing, the data throughput rate of the proposed receiver will be sufficient to carry the entire observable bandwidth of MWA to the central processing station. This would enhance the sensitivity of the array, when equipped with a wideband correlator. An efficient implementation of a polyphase filter bank-based channelization algorithm is envisaged to channelize the sampled signal into narrow sub bands. Providing access to the entire sampled bandwidth-without flagging off contaminated spectral channels due to aliasing from adjacent sub bands-ensures that there is no undesirable leakage of foreground into the EoR window. Next, this presentation will describe a 2 GHz wide-band precision spectrometer (pSPEC) built and demonstrated at RRI, using two quad 10-bit ADCs followed by an efficient implementation of 8k point channelization architecture inside a Virtex-6 FPGA. With minimal changes, two such pSPEC units could be deployed to serve as a compact digital receiver system for use with 8 tiles of MWA, as has already been in pipeline for use in the Sky Watch Array Network (SWAN) project. This configuration will have about three times the resources available in the present MWA receiver. With this leverage, we are exploring possible co-existence of normal and phased-array modes of MWA. The presentation will conclude with a cost analysis of digital receiver system for phase 2 of MWA.

IT-13	ASI2015_632	Nirmal K	Poster

A.G.Sreejitj,M.Joice,S.Mayuresh,S.Ambily,Murty Jayanth.

Pointing System for Balloon Borne Telescope.

We propose the design and implementation of light weight ,completely automated pointing system for balloon borne telescope.The system is developed using off the shelf componenet such as arduino uno controller,HMC 5883l magnetometer and MPU -9150 Inertial Measurement Unit(IMU).It is very compact and rugged ,which can be used to take image/ video in a moving vehicle.We discuss the advantages of such kind of system,accuracy related issues and drawbacks.More stress is given to calibration of different component as well as ground based testing.At present,system can track sun/moon with an accuracy of 0.5^0.

IT-14	ASI2015_637	B. V. N. KAPARDHI	Poster

D. Anand, D.K. Ojha , V. Anmi Reddy, T.V. Rao, Dharmesh T, Santosh K. Balloon Facility of Tata Institute of fundamental Research.

An overview on Instrumentation used in scientific ballooning

Since it's inception in 1970, the Balloon Facility of Tata Institute of Fundamental Research (TIFR) has served the scientific community from within the country as well as from abroad for conducting balloon flights carrying payloads of scientific experiments in Cosmic Ray, X-Ray, Gamma Ray and Infrared Astronomy, Astrobiology as well as Atmospheric sciences. Several important and interesting results have being obtained from these balloon-borne experiments. TIFR Balloon Facility is a unique Centre of technology which offers complete solutions in scientific ballooning for high altitude studies. The Centre has an in- house balloon production facility and ground facilities for balloon launching and recovery operations. A control room fully equipped with S-band telemetry, tracking and control capabilities for handling the data and control operations. A balloon launch area at the balloon facility gives operational flexibility and optimal utilization of the available manpower. This paper will present an overview on various instrumentation that is being used in scientific ballooning.

IT-15	ASI2015_651	Sanket Jayvantbhai Kotak	Poster

Ashutosh Bajpai (TIFR,Mumbai) Kallol Mukerjee (TIFR,Mumbai) Irfan Mirza (TIFR,Mumbai) Navita Thakkar (SAC-ISRO,Ahmedabad) K.P.Singh (TIFR,Mumbai)

Science data analysis technique for Soft X-ray Telescope of Astrosat

This paper describes technique used for analysis of science data which would be obtained through astronomical observations by Soft X-ray Telescope; an instrument on board Indian satellite mission, ASTROSAT. The architecture of software system is so designed to include all the required configurations and components that make up complete data analysis chain with the concept of automated data pipeline processing system. This pipeline processing architecture is most suitable for applications those require a well defined processing steps and series of computations to be performed on time ordered data. In order to accurately analyze data, updated calibration database (CALDB) must be generated and made accessible on local directory. Data received from the spacecraft, via telemetry dumps at the ground station are defined as Level-0 raw data files and are used to create Level-1 FITS files containing decoded raw packets from the instrument. These files then undergo a data processing chain that automatically or optionally semi-automatically perform the data-reduction and data-analysis processes for the SXT instrument. The overall process include event extraction and time tagging from telemetry packets, coordinate transformation, bad and hot pixel detection, bias and gain-offset corrections, data filtering and screening and generation of calibrated and cleaned event lists for generation of Level-2 data products such as image, spectrum, light-curve. The cleaned event file so generated can undergo further processing by standard astronomical tools for further analysis of the science data. The basic design of the analysis software and preliminary results obtained are presented in this paper.

IT-16	ASI2015_657	Kaushal Buch	Poster

AjithKumar B., GMRT, NCRA-TIFR Yashwant Gupta, NCRA-TIFR

Real-time Radio Frequency Interference Mitigation for the GMRT Wide-band Digital Backend

The Giant Metrewave Radio Telescope (GMRT) is one of the most sensitive instruments for observing astrophysical phenomena at metre wavelengths. Currently, the GMRT is undergoing a major technological upgrade which is aimed at achieving almost seamless frequency coverage from 130 to 1450 MHz, with a maximum instantaneous bandwidth of 400 MHz, which will lead to a significant increase in the sensitivity and capabilities of the radio telescope. While the increase in receiver bandwidth would result in better signal-to-noise ratio, it also likely to encounter higher levels of man-made radio frequency interference (RFI). In order to achieve the expected sensitivity and dynamic range, it is necessary to mitigate the effects of RFI from the astronomical signal. This paper describes real-time filtering techniques for excision of broadband RFI from the Nyquist-sampled (800 MHz) digital time series of the received signal. This non-linear filter uses robust statistical estimation through Median Absolute Deviation which is followed by filtering of samples that are detected outside the robust threshold. This RFI filter is optimized for operation in real-time on the Field Programmable Gate Array (FPGA) board used for receiving the digitised signal. It is currently being tested with the new GMRT wideband backend (GWB). Initial test results show successful removal of broadband RFI and subsequent improvements in the signal-to-noise ratio. This paper describes different modes of operation of the filter and the test results in detail, and also outlines the plan for future development and use in regular observations. An introduction to the filtering of narrowband interference using the same technique operating on the spectral domain data is also provided, along with the test results from simulations. The broad plan for future development of real-time RFI filtering techniques for the upgraded GMRT is also outlined.

IT-17	ASI2015_660	Tarun Kumar Sharma	Poster

Padmakar singh Parihar

A Direct Dive based Telescope for MASS-DIMM Instrument

At Indian Institute of Astrophysics we have begun a programme to develop site survey instruments. The instruments are developed as a part of the site survey program for the NLOT (National Large Optical Telescope), which will be an 8-10 meter class state of the art telescope. Extinction and sky brightness Monitor, and IR sensor based All Sky Scanning Cloud Monitor are designed and developed. From TMT Project USA a MASS-DIMM device has been acquired. The Multi-Aperture Scintillation Sensor (MASS) is a device which measures the scintillation effect in stellar light and provides a vertical structure of atmospheric turbulence. Whereas the DIMM uses the fluctuation in the phase of the incoming wavefront, and provides the seeing information. This device however requires lot of modifications in the software as well as a very sturdy telescope. One of the prime requirements of the instrument is that it needs very stable telescope which can work in open and windy condition. The telescope will be an Alt-Az mount telescope. In order to reduce wind induced shaking/disturbances, the cross section area of the telescope is minimized. Telescope truss is made as light weight as possible to have a fast response. We also make use of Direct Drive Technology. This technology relies on coupling the specially designed motors to the load axis directly without any intermediate reduction system (gear, timer belts, friction drive etc.). The driver required to operate direct drive motors are designed and developed in house. In addition to driver, the telescope controller and control electronics for optical encoders and position sensors are also developed. A dedicated GPS (Global Positioning Device) system will be integrated with control electronics to very precisely obtain the time and position information. This poster covers all the aspect of the telescope like mechanical design, motors, motor drive and telescope controller. We also present the results of different laboratory experiments conducted on the direct drive motor, motor drive and controller.

IT-18	ASI2015_666	Avyarthana Ghosh	Poster

A.N. Ramaprakash, Durgesh Tripathi

Performance Modelling of the Solar Ultraviolet Imaging Telescope on-board Aditya-L1

The Solar Ultraviolet Imaging Telsecope (SUIT) is one of the payloads on-board the Aditya (a satellite placed in the halo-orbit around the first Lagrangian point (L1) of the Sun-Earth system). It is an imaging telescope making full-disk observations of the Sun within the wavelength band 200 nm to 400 nm. The telescope has a set of 8 filters out of which 5 are narrowband and 3 are wideband. The narrowband filters are at 214 nm, 388 nm, 300 nm, 279/280 nm (Mg II h and k lines) and 397.8 nm (Ca II line) whereas the wideband filters are at 200-240 nm, 240-300 nm and 320-360 nm. The incoming photon counts, the filter responses, the quantum efficiency of the CCDs used as well as the reflectivity of the aluminium mirrors used are different at these wavelength bands. Hence the throughput calculation for each of these filters have been done. The imaging performance of the telescope has also been carried out to have a prototype image of the Sun as will be seen by SUIT.

IT-19	ASI2015_673	Saurabh Singh	Poster

Ravi Subrahmanyan, N.Udaya Shankar Raman Research Institute, CV Raman Avenue, Sadashivanagar, Bangalore 560080, India rsubrahm@rri.res.in, uday@rri.res.in

Precision receiver for detection of redshifted 21cm signal from the Epoch of Reionization

Red shifted 21 cm from the Epoch of Reionization is one of the key tools to study first stars and galaxies. It is technologically challenging to achieve the high dynamic range required to detect this signal of a few mK in the presence of bright galactic and extragalactic foregrounds. In this presentation, we discuss the system architecture developed by us for the detection of global redshifted 21 cm signal in the frequency range 40-250 MHz using a broadband precision spectrometer and a frequency independent disk-cone antenna. The present system measures differential temperature between the antenna and a known reference load. Bandpass calibration is achieved by coupling a switched noise source into the signal path. Another dedicated noise diode is used to make in-situ measurement of antenna impedance and its mismatch to free space. We have carried out extensive laboratory tests to estimate the performance of the system and Monte Carlo simulations to study the effectiveness of the data analysis methods adopted for the detection. We demonstrate that the system is capable of detecting signals of a few mK. Our approach to data analysis and preliminary results from the first sky observations using the system will also be presented.

IT-20	ASI2015_703	Tanmoy Chattopadhyay	Poster

1. Santosh Vadawale, PRL 2. S. Goyal, PRL

Development of a Hard X-ray Focal Plane Compton Polarimeter

Polarisation measurements of celestial astrophysical sources in X-rays offer unique opportunity of detailed study of behavior of matter in extreme gravitational and magnetic field. Hard X-ray polarimetry is specifically useful since at higher energies expected polarisation from the sources is higher than that at lower energies. Compton polarimeters when coupled with hard X-ray optics can provide sensitive polarisation measurements in hard X-rays with a broad energy band. In this regard, we are developing a focal plane hard X-ray Compton polarimeter consisting of a plastic scintillator as active scatterer surrounded by a cylindrical array of CsI scintillators. The scatterer is of 5 mm diameter and 100 mm length obtained from Saint–Gobain as an integrated module containing plastic scintillator (BC404) coupled to a photo-multiplier tube (PMT; Hamamatsu R6095). In the polarimetric configuration, the scattered photons from plastic are collected by 16 CsI(Tl) scintillators (5 mm X 5 mm X 150 mm) which are read by Si Photomultiplier at the end of each of the CsI tubes. Sensitivity of Compton polarimeters critically depends on the lower energy detection limit of the active scatterer and the surrounding scintillators and thus it is important to know the characteristics of scintillators at lower energy depositions in order to have a realistic estimate of the energy range and sensitivity of Compton polarimeter. Here we describe briefly the characteristics of the plastic scatterer and the CsI absorbers. Finally we will show the preliminary experimental results obtained from the final configuration of the Compton polarimeter and compare with the simulation results.

IT-21	ASI2015_712	Tarun Bangia	Poster

Arun Ghanti *PPS,Pune

Material Handling Systems for 3.6m Telescope Enclosure at Devasthal, Nainital.

Aryabhatta Research Institute of Observational Sciences (ARIES), an autonomous institute under Department of Science and Technology (DST), is setting up a 3.6m optical telescope at Devasthal (29o21' N, 79o41' E, 2450 amsl), Nainital. AMOS, Belgium has designed, manufactured and supplied the 3.6m telescope components to ARIES. One of the challenges for ARIES was to build an enclosure consisting of 29m high steel building, with rotating cylindrical steel dome of 16.5m diameter to house the 3.6m telescope, at remote hilly site of Devasthal. Another challenging task was to provide material handling systems for installation of 3.6m telescope in its enclosure. Transporting of tower crane or mobile crane with 15 to 20 ton capacity of required boom length was not feasible due to constraints in the bridges in route and also space constraints at Devasthal site. Hence specific material handling systems were designed and manufactured to meet the requirements of 3.6m telescope installation from inside the enclosure. The three customized material handling systems installed in the 3.6m enclosure consisted of one 20 ton capacity motorized transfer trolley moving over rails, two 10 ton capacity single girder cranes in extension building with a span of 11.15m and two under-slung 10 ton capacity cranes in dome with a span of 4.9m. Manufactured four 10 ton capacity cranes were tested as per IS3177 to ensure safe handling of telescope components and its delicate mirrors. Cranes were provided with crane duty motors, VVVFD compatibility, digital load display, pendant control, provision for tandem operation and radio remote control. Apart from the vital role of material handling systems in installation of 3.6m telescope, they will also be very useful for carrying out maintenance activities in future. Cranes when parked will not interfere with the telescope movement during observations and are provided with low hook height and lesser carriage width. Single girder, extension building cranes are being used for loading of telescope components on motorized transfer trolley which transfers the components below the hatch opening of 5.5m x 5.5m size in observation floor of dome building. Further under-slung dome cranes are used to lift telescope components from hatch up to observational floor and thereafter cranes and dome movement facilitate placing of components at required location. Presently installation of 3.6m telescope is in progress by the AMOS team of Belgium at Devasthal site with the help of material handling systems provided by ARIES in the 3.6m enclosure.

IT-22	ASI2015_732	Varun Kumar	Poster

Sreekanth Reddy V., Padmakar Parihar, Sachin Bhat (Indian Institute of Astrophysics, Bangalore 560034)

Edge Sensor for Segmented Mirror Telescope

Segmented mirror technology is becoming natural choice for any telescope larger than 8 meter in size. Performance of a segmented mirror telescope primarily depend on its edge sensors, actuators, primary mirror control and alignment-phasing system. Edge sensor plays a very vital role in segmented mirror telescope and it precisely detect any relative displacement between mirror segment, induced by either gravity or wind loading. Edge sensor is expected to not only measure relatively large displacement with nano-meter precision but also should have ability to simultaneously measure more than one dimensions, should not get affected over varying environmental conditions and should have temporal stability extended over period of a month. Various groups are working to develop edge sensor which can meet these stringent requirements and most of them are private companies. It has been found that performance of a capacitance based edge sensor is limited by their sensitivity towards excessive humidity, dust and condensation, whereas, inductive sensor is expected to be free from all these problems. Inductive edge sensor uses principle of mutual inductance measurement between two planner coils, placed on each sides of mirror segments. The mutual inductance of these sensor varies with overlapping area of the coils as well as gap between them. Whereas, capacitive edge sensor which can meet all required technical specifications can be a simple parallel plate capacitor crafted on a very stable base usually made of same material used to make the mirror segment. Both the sensors have transmitter and receiver half mounted on sides of two segments facing each other. The transmitter half of both inductive and capacitive sensors are excited with sinusoidal signal and the change in the signal at the receiver end is demodulated by applying different methods. In the ITCC laboratory of IIA we have been working on a project to develop inductive and capacitive edge sensors, which should not only full-fill all technical requirements, but also be very cost effective. Here we report the progress made in developing edge-sensors and related electronics as well as preliminary test results obtained in the lab.

IT-23	ASI2015_734	P.K. Mahesh	Poster

Surojit Kumar Roy

Manufacture of prototypes of the Segment Support Assembly of the Thirty Meter Telescope in India- Challenges and Solutions

A brief introduction to the Segment Support Assembly (SSA) of the Thirty Meter Telescope will be made. Following this, some of the technical challenges faced in the manufacture of the prototype of the SSA in India and the solutions for them will be outlined.

IT-24	ASI2015_735	Santosh Vadawale	Poster

On behalf of CZTI team

Hard X-ray polarimetry with Astrosat-CZTI

Cadmium Zing Telluride Imager (CZTI) is one of the five instruments on Astrosat with primary scientific objective of simultaneous X-ray spectroscopy and imaging in the energy range of 10 – 150 keV. It is based on pixilated CZT detector array with total geometric area of 1024 sq. cm. Individual CZT pixels are of 2.5 mm x 2.5 mm size and 5 mm thick. Such pixilated detector plan can in principle be used for hard X-ray polarization measurements based on the principle of Compton scattering by measuring azimuthal distribution of simultaneous events in two adjacent pixels. We have carried out detailed Geant4 simulations to show that CZTI will be able to measure X-ray polarization the energy range of 100 – 300 keV. This capability has also been verified experimentally. The detailed estimation of polarimetric background, which determines the realistic polarization sensitivity of CZTI, show that the CZTI will certainly be able to constrain the hard X-ray polarization of bright X-ray sources, if the emission is highly polarized. We show that this sensitivity can address some important in X-ray astronomy such as contribution of relativistic jets to hard X-rays in the black hole binaries and the X-ray emission mechanism and geometry in the X-ray pulsars.

IT-25	ASI2015_788	Supravika	Poster

A.Raghunathan Associate Engineer, Radio Astronomy Lab, RRI,Bangalore and N.Udaya Shankar Professor, Dept of A&A, RRI,Bangalore

Development of planar fat sinusoidal tooth structure

21cm line of neutral hydrogen is considered as an unique tool to detect signals from the Epoch of reionization (EoR). We describe in this paper, the design and development of a planar fat sinusoidal tooth structure which can used for the precise measurement of this signal.It is an all-sky feature visible at red shifted 21cm line and is predicted to be at most 20-30mK.Detecting such a weak signal in the presence of dominant Galactic and Extra-galactic background is challenging. Precise measurement of it requires detecting device such as an antenna to have frequency independent radiation pattern and return loss characteristics. Their frequency dependence results in undesired spectral features in the measured spectrum resembling EoR signal. Radiation pattern of the antenna like a simple half wave dipole can be made frequency independent by making its structure electrically small in dimension. However, high impedance mismatch produced as a result of this, produces a large ripple in its impedance characteristics due to i) its surface current not decaying linearly away from the feed point in a frequency dependent way and ii) an increase in the radiation reactance of the antenna. These two effects could be overcome by giving an appropriate profile to the structure of the antenna. Profile plays a major role in attenuating the surface current through efficient radiation of the surface signal. We have conducted extensive electromagnetic simulation and has shown that an antenna having sinusoidally profiled structure exhibits both frequency independent radiation and impedance characteristics. To achieve both these characteristics over a large bandwidth, dipoles are made generally very fat. However, with that arrangement, it is difficult to design the antenna which can respond to two orthogonal polarizations simultaneously. To achieve this specifically, along with frequency independent radiation and smooth impedance characteristics, over a large bandwidth, we have designed a planar fat sinusoidal tooth structure to operate in the frequency range 100 – 1000MHz.In this talk, we present the challenges faced in the design, methodology adopted in the process of fabrication and measurements of the radiation patterns.

IT-26	ASI2015_791	Vineeth Valsan	Poster

S. Sriram (Engineer E, IIA), P. K. Mahesh (Engineer E, IIA), J. P. Lancelot (Engineer E, IIA), G. C. Anupama(Professor, IIA)

Validating the warping theory of Stressed Mirror Polishing for TMT segments

TMT-India will be polishing 15% of the total primary mirror segments for TMT using Stressed Mirror Polishing (SMP) technique. Stresses are applied to the mirror blank in order to elastically deform the desired surface into a sphere. Once the required surface accuracy is obtained upon polishing , the stresses are released to deform the spherical surface to the desired one. The theoretical modeling of initial stress that has to be applied was developed by Lubliner and Nelson. This paper deals with the verification of this stress using FEM analysis. The possible irregularities on the surface profile of the segments arising out of the improper application of the stress is also discussed.

IT-27	ASI2015_799	Jitendra Pralhad Kodilkar	Poster

Niruj Mohan, jitendra Kodilkar, jayram Chengalur (NCRA),Mihir Kulkarni, Ketan Rikame, Navathej Genesh (IISER), Aakash Patil, Nilay Mokashi, Ramchandra Karanje (S.P. Univ of Pune)

Characterization of a new 15-m radio telescope at NCRA

We present results of characterization of the newly commissioned 15-m radio telescope at the NCRA campus. Operating between roughly 1000-1500 MHz, this telescope has newly been fitted with an upgraded back-end as well as a modern monitoring and control system. An automated pipeline is also being written for data analysis. Here we present results from recent characterization tests, as well as science verification experiments. We also describe the novel pipeline connecting the monitoring and control system, the data acquisition and processing and the final data analysis package.

IT-28	ASI2015_823	CHAITANYA RAJARSHI	Poster

Ranjan Gupta -IUCAA B.G.Anandarao- PRL

DESIGN & DEVELOPMENT OF FABRY-PEROT BASED SPECTROMETER FOR IUCAA 2 M TELESCOPE

In order to enhance the observational capabilities of 2 m telescope at IUCAA Girawali Observatory, an Imaging Fabry-Perot Spectrometer (IFPS) is currently under development. The planned IGO-FP covers a wavelength range of 400-800 nm with a set of several pre-filters for isolating the emission lines of interest defined by the science drivers. The spectral resolving power is ~ 8000 @ 600 nm (spectral resolution of ~ 0.07 nm and velocity resolution of ~ 36 km/s) and a field of view of 7.2 arc-min. The background limited sensitivity for extended source should be of the order of 2.5 × 10−17ergs/sec/cm2/°A/sq. arcsec, relevant to IGO sky. IFPS is well suited for velocity field mapping in extended sources in a given spectral emission line as well as in imaging of an extended region in a particular emission lines for the background can be subtracted by tuning the IFPS off the line. An off-shoot of this capability is in obtaining ratio maps of emission lines for understanding the emission mechanism or in some cases for knowing the extinction variation. The dynamics of an extended sources (e.g. planetary nebula etc.) can be well understood with this technique.

IT-29	ASI2015_847	Hemanth Pruthvi	Poster

Dr. K. B. Ramseh, Indian Institute of Astrophysics (IIA).

A two-channel imaging system at White light Active Region Monitor (WARM) telescope at Kodaikanal observatory: Design, development and preliminary resu

One of the proposed back-end systems for the National Large Solar Telescope is Broad Band Imaging System (BBIS), which is intended to perform simultaneous observations of the Sun in multiple wavelengths. Information about solar activity at different depths can be obtained from these kind of observations. As first step, a prototype system is developed at Kodaikanal Observatory, using the White light Active Region Monitor Telescope as the front end. Though it is a low resolution telescope, we hope to use the back-end as a test bed for the future experiments concerning the BBIS. This back-end system has three channels: one for the auto guiding and two for the imaging. Preliminary observations are done with only two imaging channels, and a set of low resolution near simultaneous full disk images of the Sun are taken. Dark and flat correction are done, and limb darkening is removed.

IT-30	ASI2015_867	Bhupesh Saxena	Poster

Padmakar Parihar, Indian Institute of Astrophysics, Bangalore Muneer S. Indian Institute of Astrophysics, Bangalore Rajesh Sharma M.P.Council of Science and Technology, Bhopal Pramod K Verma M P Council of Science and Technology, Bhopal

Varahmihir Astronomical Observatory, Dongla, Ujjain

M.P. Council of Science and Technology (MPCST), Bhopal has established an astronomical observatory at Dongla, Ujjain, named “Varahmihir Astronomical Observatory”. The place is situated exactly on the tropic of cancer (longitude 75o45’ 45.5”E and longitude 23o26’43.2”N), and was a center of ancient Indian astronomy over several hundreds of years. Observatory site is relatively dark, having moderate seeing and found to have a large number of clear nights during September-April months. The long spell of clear nights is best suited for continuous monitoring of variety of variable stars and the transient objects. Observatory has a medium size robotic Optical Telescope equipped with a large format advanced CCD imaging camera. The dome and dome building are made of steel and telescope is installed on the top of 10-m high concrete pier. Inside the observatory campus, guest house, auditorium, library and computing facilities have also been created. The telescope saw the first light on June 10, 2013. Thereafter it took some time to resolve problems of integrating CCD with the telescope as well its close loop cooling mechanism. The telescope now is ready for astronomical observations and educational training programme. In this poster, we report our efforts to characterize the site as well as the telescope-CCD system. We also report preliminary scientific observations carried out using the facility.

IT-31	ASI2015_870	Sivarani	Poster

S. Sriram (IIA), S. M. Faber(UCSC, California), Krishna Reddy(ARIES), P. Shalima(IIA), Devika Divakar(IIA), P.Ramya(IIA), Vineeth Valsan(IIA), R. Banyal (IIA), A. Subramaniam(IIA), Brad Holden(UCSC), Andrew Phillips(UCSC), Nick Konidaris (Caltech),Matt Radovan(UCSC), Chuck Steidel(UCSC), Luc Simard (TMT)

TMT-MOBIE: MCS (Metrology, Calibration and Simulation) Ministudy

MOBIE (Multi OBject Imaging Echellette) is a first-generation wide-field seeing-limited instrument for TMT. The spectrograph has two color channels simultaneously spanning 310-550nm and 500-1100nm passbands. The instrument will be mounted at the TMT +X Nasmyth focus which is coaxial with the telescope elevation axis. The entire instrument needs to be rotated with respect to the Nasmyth axis in order to correct for the field rotation during an observation. This can introduce a variable flexure during an exposure. Here, we present some of the ongoing work that is being done as part of the MOBIE Mini-study MCS (Metrology, Calibration, and Simulation). One of the main motivation of the ministudy is to design a Flexure Compensation System (FCS) for MOBIE. As an initial step, we have mapped the spots corresponding to different field positions on the detector. We also calculate the distortion, anamorphic factor in the slit direction, and review possible impacts on planning observations and calibration. We construct a sensitivity matrix for the optical components to design the FCS system. We will also evaluate the accessible range of the detector-hexapods that can be used to compensate for the image shifts.

IT-32	ASI2015_893	Singam Srikanth Panini	Poster

K.C.Shyama Narendranath (ISRO), M. Nayak (RRCAT), G. Lodha (RRCAT), P. Sreekumar (IIA), V. Valsan (IIA)

X-ray reflection optics : Revisiting multilayer normal incidence optics for soft x-ray studies.

X-ray optics is now a firmly established requirement to enable astronomical imaging as well as for high signal-to-noise studies. Though mirror efficiency is higher with grazing angle incidence, there are many advantages to the realization of a normal incidence x-ray mirror, specifically in the context of increasing the ratio of collection area to payload volume. This is viable only if normal incidence reflectivity is increased through the use of multilayer deposition. We present some initial plans and designs of multilayer normal incidence x-ray mirrors that can increase reflectivity. Results from testing of sample multilayers built at RRCAT, will be presented.

IT-33	ASI2015_894	Prasun Dutta	Poster

Suman Majumdar Stockholm University · Department of Astronomy

The Bispectrum Way

Many aspects of radio astronomy deals with statistical fluctuations of the observed intensity, HI intensity fluctuations from reionization or nearby galaxy, synchrotron emission from spiral galaxies or supernovae remnant of our galaxy are to name a few. Most of the present estimators of these statistical fluctuations aims to measure the power spectrum or the two point correlation functions, hence quantifying its Gaussian nature completely. Higher order statistics are particularly important for quantifying the non linear structures from the epoch of Reionization Era, or ISM turbulence, where three point interactions are natural. However, literature present lacks estimators of the higher order statistics. In this work we propose a visibility based estimator to quantify the bispectrum of the sky brightness fluctuations in the radio interferometric data. Since bispectrum is a function of three variables (which are shown to constitute the sides of a triangle), in literature several bispectrum estimators are considered based on triangles of specific geometry. We realise, given an interferometric array configuration and the direction in the sky an observation is carried out, it is possible to estimate the efficacy of measuring bispectrum for triangles of all possible shapes from an observed data. For an upcoming radio telescope, like Square Kilometre Array (SKA), using this method one can predict the best possible antenna configurations to get the best estimates of bispectrum for triangles of required geometry set by the science objectives. Challenges in estimating bispectrum, our approach and its applications will be discussed.

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ASI-2015 Poster Presentations

Other

Oth-1	ASI2015_378	Ananda Hota	Poster

RAD@home Collaboration

Progress report on RAD@home Astronomy Collaboratory, India (#RADathomeindia #ABCDresearch)

As noted by Marshall, Lintott & Fletcher (2015, ARAA vol. 53), RAD@home is a “"a zero-funded, zero-infrastructure, human-resource network' using free web services and public astronomical data archives (using existing infrastructure) to organise and enable citizen astronomy research." A progress report on this first Indian citizen-science project will be presented. It has been spreading fast all over India (on average, two new member joining everyday). With 1150 members, it is the largest Indian astronomical group/page/profile in Facebook. It is powered by S3N3_India network, which has been funded by DST, Govt. of India. S3N3 has 5500 subscribers and can reach 40,000 people. for a single news Joining RAD@home is just a click away and absolutely free. Any BSc/BE student/qualified-person, employed/unemployed, Indian can join https://www.facebook.com/groups/RADathome/ . Sseveral thousands of multi-wavelength (UV to radio) galaxy images have been uploaded and analysed in Facebook. Nearly 40 Indians were selected and trained in one-week (~70 hrs) RAD@home Discovery camps, held in institutes like CBS (Mumbai), IOP (Bhubaneswar), HRI (Allahabad) and Nehru planetarium in Delhi (22-28 Dec 2014) with free local hospitality. Discoveries made by the camp participants, from TGSS-data, gets documented in Google-docs. These documents they co-author, makes these resource-poor people rich with intellectual property. They become Co-I in GTAC proposals and co-author in national/international papers (http://adsabs.harvard.edu/abs/2014arXiv1402.3674H). Thus, students get boost in their career for selection to winter/summer schools and PhD fellowships. Participants continue to discover from home and will be new workforce to tackle BIG DATA problem and needs of uGMRT, TMT, SKA, ASTROSAT, DOT etc. I will briefly report data analyses done from the project GOOD-RAC (GMRT Observation of Objects Discovered by RAD@home Astronomy Collaboratory, India). GOOD-RAC-1 and -2 focused on episodic radio galaxies and diffuse C-shaped radio emission in clusters, respectively. The hunt for galaxy filaments has also been progressing well and a poster paper on this was selected and presented in a meeting on cosmology in ICTP, Italy. I will also summarise the earlier project, hunt for Speca-2. By now, four speca-like galaxies have been published and possibly a dozen, if results from RAD@home and radio galaxy zoo projects are combined, have been tentatively identified by citizen-scientists. New analysis of Speca and similar galaxies done with the GMRT, HCT, XMM-Newton and Subaru will be presented. I will argue how RAD can not be replaced by automation and will always assist professionals. RAD@home has been contineously redefining itself as a scalable model of education-research-and-media aiming to alleviate socio-economic and geo-political constraints on the faster, inclusive, and sustainable growth of the nation.

Oth-2	ASI2015_449	Tabasum	Poster

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Evidence of Cosmic event 1054 Supernoava in Space

Crab Nebula a remnant of 1054 SN seems also to be witnessed by the sky gazers in northern part of India some time in 7, 000 YBP. We suspect that the remnant of 1054 SN is having a strong correlation with the SN observed by the Neolithians (5, 000 – 1, 000 BC) in Kashmir.

Oth-3	ASI2015_455	G.S.D.Babu	Poster

G.S.D.Babu M.P.Birla Institute of Fundamental Research Bangalore

ASTRONOMY EDUCATION BEYOND BASIC COURSES

To cater to the students who have the interest and aptitude for an in-depth understanding of the subject of Astronomy and Astrophysics, various extracurricular educational programmes have been designed and are being implemented at the M.P.Birla Institute of Fundamental Research, Bangalore. As a precursor, the high school students are given a two-week long course on basic concepts of Astronomy during their summer vacation and the students at the undergraduate level are given a greater exposure of various topics in the field of Astronomy and Astrophysics over an extended period of about six months. This longer course has actually helped the students to identify the specific topics which are more appealing to them and also to be motivated for pursuing those topics for a deeper understanding. Such students, being keen to go beyond the basics, are given the option to take up specialised courses in the topics of Astrobiology, Astrochemistry, Radio Astronomy, Solar Astronomy, Space Astronomy and Cosmology conducted as week-end classes at MPBIFR. These courses are at the post-graduate level and are covered in a span of 18 to 20 hours spread over a period of 9 to 10 weeks. All these courses are coordinated respectively by the visiting subject experts coming from various research institutes and organisations located in and around Bangalore. Each of these courses are specifically designed by the coordinators in order to make an impact with an in-depth knowledge in that particular topic. Field trips to the relevant observatories are also included for conducting on-site sessions. The students of these courses are made to go through a fairly rigorous programme of class room sessions, assignments and tests before they are awarded certificates. Further, the motivated students are encouraged to involve themselves in regular research programmes in Astronomy at MPBIFR or at any other suitable scientific institution for publishing research papers in national and international journals.

Oth-4	ASI2015_503	T.V. Venkateswaran	Poster

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Raghunathachari and his 'scientific' panchanks

Chinthamani Raghunathachari, hailed as first Indian member of the Royal Astronomical Society and employee of the Madras astronomical observatory argued for reform of the traditional Indian calenders (panchanks). Displeased with the errors in the traditional panchanks, he took upon himself to publish 'scientific' panchank in various south Indian languages including Tamil around 1880s. These almanacs alluded to the traditional panchanks (calender/year book) and drew upon elements of the 'almanacs' published by the British settlers in Madras Presidency. His scientific panchanks not only provided the computation of traditional elements such as thithi, nakshtra, yog and karnam but also elaborated on stellar phenomena, particularly those which are visible to naked eye. Solar and lunar eclipses, occultation by the Moon, and planets were some of the celestial events that found its place in the panchank. Further the 'scientific' panchank of Raghunathachary also presented a comparison between the predictions of traditional panchanks of his time and his own predictions. Moon rise time, eclipse circumstances were compared to show that his predictions were much more accurate and the traditional ones differed from the actual events by many minutes. He asked his readers to use a good wrist watch to note the timing of certain events, say moon rising or eclipse circumstances and see for themselves how the traditional computations are way off the mark. Thus by recruiting the 'public' in the dispute as adjudicator, he also disrupted the 'traditional' arrangement of appeal to authority as the means of intellectual disputes and brought to fore the 'public' nature of the modern science. Convinced by the arguments advocated by Raghunathachari two major sects, Smartha of Kancheeuram and Jeers of Ahobila matt, supported the 'scientific' panchank and called for reformation. Played out in period of emergent capitalism in Madras presidency, civil time was diverging from the sacred time. The twenty four hour clock and Gregorian calender was being widely adopted for civil purposes and the panchanks were being relegated to ceremonial and sacred occasions in the native society. As time went by, even the panchanks were presented in the equivalence of twenty four hour clocks and Gregorian calender, for the ease of the users to access it and find 'appointed' time for religious and scared ceremonies. The 'scientific' panchank lost its relevance with the march of civil time solely based on twenty four hour clocks and Gregorian calender and the use of panchank limited to finding time for certain religious ceremonies.

Oth-5	ASI2015_606	Charitarth Vyas	Poster

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Tracking Cosmological cluster accretion onto clusters of galaxies by semi-expert e-astronomers of RAD@home

Big Data problem and citizen Science research are two important concepts that any future research plans of astronomy and astrophysics can not ignore. RAD@home, unlike Zooniverse or other such projects, is more than a citizen science on the web. It is the beginning of a large public-collaboratory or network of people with minimum undergraduate-level science and engineering education, aiming eventually to alleviate some of the socio-economic and geo-political constraints on growth of the underdeveloped regions of India. Preliminary results presented here have been achieved by a network of semi-experts or e-astronomers, as we call it, located all over India and from all walks of life. RAD@home provides them training in basic astronomy education and on how to use various astronomy database and tools (NED and image analysis tools like SAO ds9 and NASA Skyview). For the discovery and exploration of interesting/important radio sources, we have used 150 MHz TIFR GMRT Sky Survey (TGSS), which has several times higher sensitivity and resolution compared to other similar low radio frequency surveys and follow them up with GTAC proposals (GOOD-RAC project). Accretion of gas and galaxies through the filaments on to the clusters can be relatively easily traced by large (over 300 kpc) distorted radio lobes than by optical or X-rayobservations. Spotting such radio sources from scale-sensitive interferometric images is non-trivial for citizen-scientists but this growing network of e-astronomers are being trained for this job by the professionals. We present here a few preliminary results on galaxies spotted by our collaboratory using free data available on the web. It includes bent-lobe radio galaxies, lobe-distortion seen only on one of the lobes, diffuse curved radio emission etc. Most importantly, we have identified a few new Mpc-size filaments of galaxies likely associated with these bent/distorted radio sources. These findings have potential to help us understand cosmological accretion on to clusters of galaxies. Reference:http://adsabs.harvard.edu/abs/2014arXiv1402.3674H Note: This poster-paper was selected and presented in a cosmology school in ICTP, Italy.

Oth-6	ASI2015_744	Pramod G Galgali	Poster

Pramod G Galgali Jawaharlal Nehru Planetarium, Bengaluru

Outreach Effort: 'India's march to Mars'

In an effort to popularise Space Sciences amongst students and common man, Jawaharlal Nehru Planetarium, Bengaluru organised a 20 day festival on the occasion of 'Mars Orbiter Mission' reaching Mars. Various components were 1.)an open air poster exhibition on the themes Space, MOM, Rockets of India, Satellites of India, Spinoffs of Space technology, and on ISRO,2.) Exhibition of scaled down models of rockets and satellites,3.) Model rocketry 4.) Workshop for children on preparation of motorised rovers 5.) Four Public lectures on Indias space efforts by senior Scientists. Sky-theatre show entitled 'Mars the Red Planet' was shown four to six times a day. The festival became a destination to the General Public, the School Students, the Print Media and the electronic Media for satisfying their curiosity about MOM and about the Space sciences. The festival became popular attracting over 18000 visitors. Print media and Electronic media covered the festival extensively. The presentation is about sharing our experience in conducting the event

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