Abstracts of Posters

(A) Sun and solar system

Studies on fast Coronal Mass Ejections during 24th solar cycle

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Abstract. The space environment of earth is significantly controlled by the Coronal Mass Ejections (CMEs). We study the properties (such as width, acceleration and location) of CMEs with speed grater than 900 km/s. Also we study the associated properties of solar flares and type II radio bursts. For the present work, the data are observed from SOHO/LASCO during the period of 2008-2012. Interesting results from this analysis will be discussed.

Role of solar influences on geomagnetosphere and upper atmosphere

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Abstract. The Earth's magnetosphere and upper atmosphere can be greatly perturbed by variations in the solar luminosity caused by disturbances on the solar surface. The state of near-Earth space environment is governed by the Sun and is very dynamic on all spatial and temporal scale. The geomagnetic field which protects the Earth from solar wind and cosmic rays is also essential to the evolution of life; its variations can have either direct or indirect effect on human physiology and health state even if the magnitude of the disturbance is small. Geomagnetic disturbances are seen at the surface of the Earth as perturbations in the components of the geomagnetic field, caused by electric currents flowing in the magnetosphere and upper atmosphere. Ionospheric and thermospheric storms also result from the redistribution of particles and fields. Global thermospheric storm winds and composition changes are driven by energy injection at high latitudes. These storm effects may penetrate downwards to the lower thermosphere and may even perturb the mesosphere. Many of the ionospheric changes at mid-latitude can be understood as a response to thermospheric perturbations. The transient bursts of solar energetic particles, often associated with large solar transients, have been observed to have effects on the Earth's middle and lower atmosphere, including the large-scale destruction of polar stratospheric and tropospheric ozone. In the present, we have discussed effect of solar influences on earth's magnetosphere and upper atmosphere that are useful to space weather and global warming, on the basis of various latest studies.

Statistical study of slow and fast Halo CMES during 23rd solar cycle

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Abstract. Halo CMEs are the main drivers of large geomagnetic storms. We report the properties of slow (speed <450 km s^{-1}) and fast (speed >900 km s^{-1}) Halo CMEs. These CMEs are observed from SOHO/LASCO CME catalogue. The period of data covered is from 1998 to 2007. The detailed analysis will be presented.

Characterization of an AOTF based infrared spectrometer for space application

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Abstract. Solar radiation reflected from the surface of a planet and attenuated by the atmosphere can be utilised for analysing the composition of the planetary atmosphere and its seasonal changes. We are designing a spectrometer for atmospheric applications (with a focus on Martian atmosphere), which will perform in the near infrared range of 1-1.7μm. The abilities of this instrument are manifested in the results from experiments carried out in the laboratory. With the calibration of AOTF (e.g. wavelength-frequency tuning, AOTF transfer function and its dependence on temperature etc.) and the noise characterization of detector (as function of integration time, temperature etc.), we have demonstrated the working concept of the instrument. The total response of the instrument (including AOTF bandwidth and noise levels of the detector) is found to be capable of detecting the features of the Martian atmosphere like the CO2 and H_2O. The sensitivity requirements of the instrument are analysed using a radiative transfer code meant for the calculation of absorption through the Martian atmosphere.

Dispersion characteristics of kinetic Alfven waves in a multi-ion cometary plasma

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Abstract. We have studied the stability of the kinetic Alfven wave in a plasma composed of hydrogen and positively and negatively charged oxygen ions and electrons which approximates very well the plasma environment around comet Halley. In the direction parallel to the magnetic field, the electrons have been modelled by a drifting Maxwellian distribution. In the perpendicular direction, another ring simulated by a loss cone type distribution, obtained by subtracting two Maxwellians with different temperatures, model all the constituents of the plasma. The dispersion relation derived for KAWs is a generalisation of the pioneering dispersion relation of Hasegawa on two counts: it has been extended to a plasma described by a generalised distribution function and to a multi - ion plasma containing positively and negatively charged ions. We find that the dispersion characteristics of the KAW can be made independent of the heavy ion parameters by an appropriate choice of densities and temperatures. The source of free energy for the instability is the drift velocity of the electrons; the growth rate increases with increasing drift velocity of the electrons. The positively charged heavier ions enhance the instability while the negatively charged heavier ions tend to damp the wave.

On the relationship between filament eruption, associated CME and coronal downflows

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Abstract. Here we present the multi-wavelength observations of the relationship between asymmetric filament eruption, associated CME and coronal down-flow on

17-18 June 2012 during 20:00 UT-05:00 UT. We use SDO/AIA and STEREO-B/ SECCHI observations for the study of filament evolution and eruption, while LASCO C2 observations for the CME analysis. Observed filament shows asymmetric eruption with its suppressed part due to the presence of overlaying magnetic field. A two ribbon flare has been observed only underneath the suppressed part of the filament. The eruption later gives a slow CME (speed ~376 km/s) that is observed by the LASCO coronagraph. The fall back of the CME core has been observed after its interaction with the coronal rays. The interaction most likely produces a drag force, which decreases the speed of the CME and thereafter downflow of its core with a speed of ≈57 km/s. We interpret these observations in the light of existing theories of CME and coronal ray interaction.

Electrostatic instabilities in multi-ion plasmas

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Abstract. We have in this paper studied the stability of electrostatic waves in a plasma composed of hydrogen, positively and negatively charged oxygen ions and electrons, which very well approximate the plasma environment around a comet. Modelling each component by a ring distribution, we find that the electrostatic waves can be generated at frequencies comparable to the ion plasma frequency. The dispersion relation has been solved both analytically and numerically. We find that the ion-acoustic waves can be excited in the plasma even if the electron temperature is comparable to the ion temperature. The effect of the heavy ions is to aid/damp the instability depending on whether they are hotter/colder than the lighter hydrogen ions.

Rayleigh Taylor instability in solar atmosphere

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Abstract. Rayleigh Taylor instability is a prominent instability which could be used to understand the energy transport mechanisms in the convection and photospheric layers. The RT (Rayleigh-Taylor) instability occurs when a lighter fluid supports a heavier one. The solar atmosphere comprises of a magnetic field structure which may act as a lighter fluid and support the solar plasma. In different situations, this kind of configuration could drive RT instability. We have studied this instability and developed an expression to understand the prominent factor to influence this instability in the solar atmosphere. Specially the kinetic pressure induced with gravitational drift

tends to increase the instability with enormous growth rate and getting damped with higher wave vector.

Eruption of filament associated with active region NOAA 11444 as observed by AIA and HMI

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Abstract. We studied an active region filament eruption associated with C-class flare that occurred on March 27, 2012, using EUV imaging data from Atmospheric Imaging Assembly (AIA) and line-of-sight magnetogram data from Helioseismic and Magnetic Imager (HMI) on board the Solar Dynamics Observatory. The filament was located in between opposite polarity region in AR NOAA 11444. The complete filament eruption took place in two stages. In the first stage, a portion of the filament was erupted at ~ 02:40 UT on March 27, 2012 with an initial velocity of about 78 km sec^{-1} and later reached 108 km sec^{-1}. A pre-flare brightening was seen 50 min before the first eruption below the filament in the lower atmosphere of the sun. The main flare started about 15 minutes after first phase of eruption initiated. We observed a continuous flux cancellation initiated ~12 hr prior to eruption and it stopped just after eruption of the first part of the filament. The other part of the filament has erupted at about 04:13 UT on the same day. In this work, we present in detail the changes occurred in the magnetic configurations and velocity fields at the photospheric level before and during the filament eruption. We also present results on the change in helicity flux injection before and during the filament eruption.

Polarization studies of the Type-I storm bursts at low frequencies

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Abstract. Gauribidanur Polarization Interferometer is the instrument used to carry out the observation of Sun every day in the frequency range of 40-120 MHz. Using this circularly polarized non-thermal radio bursts in the solar corona was observed in both Stokes-I and Stokes-V. These bursts have continuum as well as the number of periodic spikes superposed over the continuum. The distribution and polarization studies of these events were carried out. The distribution of these bursts follows the power law and its index was <-2. Also, the estimated average energies of these bursts are $\sim 10^{21}$ ergs. These are the weakest energy release events observed in the solar atmosphere till date, which needs to be explored yet.

A numerical code for scintillation studies

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Abstract. The thin screen approximation is widely used in understanding the inhomogeneities that give rise to the scintillation of, for example, radio sources shining through the solar wind. We develop a code to explore whether it is possible to go beyond the thin screen approximation for examining the propagation of the wavefront. The code may be used as a tool for exploring the characteristics of the turbulent screen and the variation of the pattern with frequency.

Long term variations in the solar chromosphere – Ca K line profiles

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Abstract. The previous studies show that there is a lack of information on the variation of network flux with solar cycle phase and also the center of solar disc was found to show no variation with solar cycle phase (White and Livingston 1978). A study on solar variability model (Skumanich et al. 1984) shows that there is an excess component during the solar maximum phase. Therefore the above mentioned studies, forms the basis for the development of new programs (Jagdev Singh 1989) at Kodaikanal tower telescope since 1986 to monitor Ca K line profiles as a function of latitude and integrated over the visible 180° longitude. The huge database is being used to study the various parameters of the Ca K line and to study the variation of chromospheric flux as a function of solar latitude with solar cycle phase. Activity related with sunspots has been studied widely but variations in the polar regions have not been observed systematically. Our data permits to study the changes in polar regions systematically and its implications to the magnetic cycle of the Sun. Here we shall discuss the results about the variation in the chromospheric flux in terms of CaK plages, network and background flux. These variations have long and short term implications on the climatic modeling.

Lunar X-Ray Fluorescence (XRF) observations with C1XS during weak solar flares

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Abstract. Chandrayaan-1 X-ray spectrometer (C1XS) was designed to map the composition of major rock-forming elements (viz., Mg, Al, Si, Ca, Ti, and Fe) on the lunar

surface. Characteristic elemental XRF signatures are observed when X-rays emanating from the Sun during solar flares excite lunar surface material via the photo-electric effect. Unfortunately, a low level of solar activity prevailed over the entire duration of C1XS observation (~9 months). Spectra containing the XRF lines of all the elements were seen during the brightest flare event (C3 flare) which occurred on 5th July 2009. Analysis of the above and the results were reported by Narendranath et al. One of the interesting results was the possibility of a greater albite content in the surface material indicated by the high Al and detection of Na. Due to lower solar X-ray intensity during weak solar flares, only low Z elements are excited. Moreover, statistics for spectral analysis demands a trade-off in spatial resolution wherein, spectra from many ground pixels have to be added to generate a good spectrum for analysis. We derive abundances of Mg, Al and Si and possible upper limits for Na content from this data. Lunar surface composition thus derived at coarser spatial scales (~1000s of km) provides insights into large scale compositional heterogeneities on the lunar surface. Spectral and elemental analysis of lunar XRF data from weak solar flare conditions are presented here along with results and their interpretation.

Study of the dynamics of the corona using July 11, 2010 eclipse data recorded from Easter Island

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Abstract. Spectroscopic observations of the solar corona were performed during the total solar eclipse of 11 July 2010 in the green line at 5303 Å [Fe XIV] and the red line at 6374 Å [Fe X] from Easter Island, Chile. The data is analyzed to study the periodic variations in the intensity, line width and doppler velocity using wavelet analysis at all pixels within our field of view. We have found that there are few locations where significant oscillations are present. These oscillations can be interpreted in terms of the presence of magnetoacoustic waves or Alfvén waves in the corona.

Emission line ratios as coronal thermometers

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Abstract. Temperature of the solar corona can be derived from emission lines based on the intensity ratios of spectral lines from two different stages of ionization of the same element. The spectral lines at 6374 Å (Fe X; Red emission line) and at 5303 Å (Fe XIV; Green emission line) are selected for this study. The emission lines in the visible wavelength range were chosen due to the large separation between lines which allow one to study these emission lines even with poor spectral instruments, like filter

based observations. In order to understand the effects of temperature, density, and emission measure on the line ratio, simulations are carried out using CHIANTI. CHIANTI version 6.0 (SSWIDL software package) is used to calculate line intensities for temperature range 10^5 K - 10^7 K, density range 10^7 cm^{-3} - 10^9 cm^{-3} and emission measure (EM) range 10^{26} cm^{-5} - 10^{28} cm^{-5}. It is concluded from this simulation that the line ratio between the green and red emission line are independent of the density and EM of the coronal plasma, providing an ideal diagnostic tool for coronal temperature studies. This simulation is also used to generate a calibration curve between the temperature and line ratios. This calibration curve is then used to convert the observed line ratios to temperature. Coronal temperatures are studied using two total solar eclipse observations observed on 29th March 2006 (at Antalia, Turkey) and on 22nd July 2009 (in China). These observations consist of simultaneous observations in the green (5303 Å; Fe XIV) and red (6374 Å; Fe X) emission lines allowing to estimate the coronal temperature. The average plasma temperature over the solar corona for 2006 eclipse is estimated as T $\approx$ 1.59 MK $\pm$ 0.43%, and T $\approx$ 1.51 MK $\pm$ 0.76% for 2009 eclipse data showing that the 2009 corona was cooler compared to 2006 data. This is due to the absence of any major activity during the 2009 total solar eclipse. The temperature variations along and across a few selected coronal structures are also studied. The results from this analysis show that the variations along and across the loops are different for different loops, for an example some loops are hotter at the top whereas some are cooler.

A study on DH-CMEs and its geoeffectiveness

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Abstract. We have studied the geoeffectiveness of 344 CMEs associated with flares and DH-Type-II radio bursts during 1997-2008, and their geoeffectiveness is complied with the minimum Dst value within $\pm$1 day with the arrival time of CMEs at earth by using ESA model (Gopalswamy et al., 2005). In the present work, the events are divided in to two groups: (i) disk events (within 30° from disk center) and (ii) limb events (beyond 60° but within 90° from disk center). The disk events on the average are followed by moderate/intense storms (mean Dst = -89 nT) compared to limb events which are followed by weak storms on average (mean Dst = -44 nT). There is no difference in the associated flare sizes for both limb and disk events. Majority of the CMEs originating from the longitudinal West of the central meridian distance are found to be geoeffective. It is also found that 30% (23 events out of 76 events) of the limb events are geoeffective, while 52% (48 events out of 94 events) of the disk events are geoeffective, which concluded that the disk events are more geoeffective than limb events.

The study of the solar cycle and its irregularities using dynamo models

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Abstract. The solar cycle is not regular. The strength as well as the period varies from cycle to cycle. One puzzling aspect of this sunspot cycle is the Maunder minimum in 17th century when sunspots disappeared for about 70 years. Indirect studies suggest that there were several other such events in the past. The motivation of our work will be first to understand the generation and the evolution of the large-scale magnetic field of the Sun and then to model some irregular features of the solar cycle. We shall present a flux transport dynamo model to study the evolution of magnetic fields in the Sun. In this model the toroidal field is generated by the strong differential rotation near the base of the convection zone and the poloidal field is generated near the solar surface from the decay of sunspots. The turbulent diffusion, the meridional circulation and the turbulent pumping are the important flux transport agents in this model which communicate these two spatially segregated source regions of the magnetic field. With this dynamo model, the speaker shall explain several aspects of the solar cycle including the grand minima. We shall also discuss the predictability of the future solar cycle using dynamo models.

(B) Stars and Galaxy

A study of variation in accretion disk parameters with phases of 'heartbeats' in IGR J17091-3624

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Abstract. The standard accretion disk model is based on a famous Shakura-Sunyaev viscosity prescription in which viscous stress is scaled with total pressure. Though the model has been very successful to explain various properties of accretion disk, it was known that Shakura-Sunyaev disk is inherently unstable in the radiation pressure dominated inner accretion disk region, particularly when local mass accretion rate is high. This instability, known as radiation pressure instability (RPI), is expected to give rise to a limit cycle behavior in which source may exhibit a series of quasi-periodic bursts. So far such behavior, popularly known as 'heartbeats' was observed only in GRS 1915+105. Recently, IGR J17091-3624, a transient black hole candidate, became the second source showing 'heartbeat' type variability during its last outburst in 2011. Here we carry out a comparative study of the variation of accretion disk parameters during such variability in both IGR J17091-3624 and GRS 1915+105. We

find that the radiation pressure instability alone may not be sufficient to explain the observed spectral variability in both the sources.

Galactic population of cataclysmic variables in soft X-rays

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Abstract. We study the statistical properties and estimate the spatial density (ρ) as well as the luminosity function (ϕ) for magnetic Cataclysmic Variables (mCVs) detected in solar vicinity by XMM - Newton Observatory in 2-10 keV. A total no. of 98 CVs (26 IPs, 47 Polars and 25 unclassified mCVs) have been selected for the task. The preliminary results of the study are presented here.

Neutron-capture nucleosynthesis in HdC stars: the case of HE 1015-2050

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Abstract. Hydrogen-deficient carbon (HdC) stars and R Coronae Borealis (RCB) type stars form a rare class of carbon-rich supergiants. A fraction of these stars in our Galaxy are known to exhibit strong features of light neutron-capture elements such as Sr, Y and Zr usually attributed to the weak component of the s-process. These stars are believed to be in a very short-lived evolutionary phase; hence, their ejecta could have significantly contributed to chemical enrichment in the Galaxy. From medium-resolution spectral analyses of faint high latitude carbon (FHLC) stars of Hamburg/ESO survey Goswami et al. (2010) have added a new member HE 1015-2050, to this rare class. This object is found to exhibit anomalously strong features of Sr in its spectrum. Possible scenarios that might have led to the formation of this object are discussed in the light of existing scenarios of HdC star formation.

Colour of cometary BCDs of the local volume

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Abstract. Cometary Blue Compact Dwarf Galaxies (II, C BCDs) are BCD galaxies that have an off center star burst, close to the end of their elongated stellar bodies. Most of them show star formation knots over the body of the galaxy, with a high rate of star formation in the brightest knot. They are sometimes considered as representing an intermediate stage in the evolution of BCDs. Here we explore the cometary BCDs of the local volume in UV - optical colors.

Spectroscopic survey for identifying the hydrogen-deficient stars in globular cluster: ω Centauri

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Abstract. Our aim is to search for new H-deficient stars in the globular cluster ω Centauri spectroscopically. The globular cluster stars are formed from the same cloud of gas and are expected to be of uniform metallicity. But, from Calamida et al. (2009) and other spectroscopic studies, it is clear that the Omega Cen stars have a range in their metallicities. Based on the study of Calamida et al., it is known that the metallicity of the cluster varies from -2.5 < [Fe/H] < 0. The mean metallicity of the cluster is [Fe/H] = -1.7. The stars from the metal rich regime of the cluster may be H-deficient, because the H-deficient field giants (e.g. RCB and HdC stars) appear metal rich due to the less continuum absorption than the normal giants. In our search for H-deficient stars, the priority is given to the metal rich ([Fe/H] > -1.0) giants of ω Centauri. However, in J_0-H_0 and H_0-K_0 colours, the H-deficient field giants are distinct from those of the normal giants and the dwarfs. Hence, for this survey we have selected all the Omega Cen giants (12 < V < 14.5), irrespective of their metallicity, having the H-deficient field giants' J_0-H_0 and H_0-K_0 colours. The low-resolution spectra for the selected candidates are obtained from Vainu Bappu Observatory, Kavalur. The data analysis for identifying the H-deficient stars is being carried out.

Silicon depletion in the interstellar medium

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Abstract. We report interstellar Si depletion and dust-phase column densities of Si along 131 Galactic sight lines using previously reported gas-phase Si II column densities, after correcting for the differences in oscillator strengths. With our large sample, we could reproduce the previously reported correlations between depletion of Si and average density of hydrogen along the line of sight, as well as molecular fraction of hydrogen (f(H2)). We have also studied the variation of amount of Si incorporated in dust with respect to different extinction parameters. With the limitations we have with the quality of data, we could find a strong relation between the Si dust and extinction. While we cannot predict the density dependent distribution of size of Si grains,

we discuss about the large depletion fraction of Si and the bigger size of the silicate grains.

X-ray emission from intermediate mass stars

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Abstract. Intermediate-mass stars are supposed to be X-ray dark because they neither drive strong winds as early type stars nor contain outer convective zones which are necessary to sustain a magnetic dynamo in low mass stars. However, the mysterious detection of X-rays from intermediate mass stars still remains an open question, and underlying physical mechanisms cannot be explained. In the present study, a sample of 29 intermediate mass stars in eight young open clusters have been analysed using XMM-Newton archival data. The spectral properties of these intermediate mass stars have been examined and compared with the spectral properties of X-ray emission from low mass stars. The X-ray luminosity and temperature distributions of intermediate mass stars and low mass stars are found to be statistically similar with a confidence level greater than 96%. Therefore, it is suggested that X-ray emission from intermediate mass stars are not significantly different from low mass stars and may arise from a nearby unresolved low mass star, i.e. companion hypothesis. However, the possibility of a similar kind of magnetic activity responsible for X-ray emission as in low mass stars within the intermediate mass stars cannot be discarded, but the presence of the magnetic field, of the order of few kG, is hard to explain in the intermediate mass stars.

SED modeling of 10 Massive Young Stellar Objects

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Abstract. We present the spectral energy distributions (SEDs) modeling of ten massive young stellar objects (MYSOs) and subsequently estimated different physical and structural/ geometrical parameters for each of the ten central YSO outflow candidates along with their associated circumstellar disks and infalling envelopes. The SEDs for each of the MYSOs been reconstructed by using 2MASS, MSX, IRAS, IRAC & MIPS, SCUBA, WISE, SPIRE and IRAM data, with the help of a SED Fitting Tool that uses a grid of 2D radiative transfer models. Using the detailed analysis of SEDs and subsequent estimation of physical and geometrical parameters for the

central YSO sources along with its circumstellar disks and envelopes, the cumulative distribution of the stellar, disk and envelope parameters can be analysed. This leads to a better understanding of massive star formation processes in their respective star forming regions in different molecular clouds.

H_2CC molecule in the interstellar space

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Abstract. Out of 180 molecules identified in the interstellar space, though H_2CO, H_2CS, H_2CCC, H_2CCCC, H_2CCO have been identified, identification of H_2CC is still awaited. Formation of H_2CC in the interstellar medium is quite probable as the cosmic abundance of carbon is 20 times larger than that of sulpher. Molecules in the interstellar medium have shown two anomalous phenomena: (i) MASER action and (ii) anomalous absorption. Anomalous absorption is a unique phenomenon which can be generated under special circumstances in an interstellar region. In the present investigation, we have solved a set of statistical equilibrium equations coupled with the equations of radiative transfer for H_2CC. Since the kinetic temperature in the medium where H_2CC may be identified may be few tens of Kelvin, we have considered 23 rotational levels of ortho-H_2CC in the ground vibrational and ground electronic states. The input data required in the present investigation are the radiative transition probabilities and the collisional rates. Calculation of collisional rates is the most difficult part in the theoretical study of cosmic molecules. We have found that H_2CC may be identified through anomalous absorption of its transition $1_{11} - 1_{10}$ at 4.89 GHz.

Anomalous absorption in H_2CO molecule

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Abstract. Formaldehyde (H_2CO) is the first organic molecule identified in a number of galactic and extragalactic radio sources through its transition $1_{10}-1_{11}$ at 4.830 GHz in absorption in 1969. Later on, this transition was found in anomalous absorption. In some cosmic objects, this transition however was found in emission and even as a maser radiation. Since the transition $1_{10} - 1_{11}$ of ortho-H_2CO is considered as a unique probe of high density gas at low temperature, the study of H_2CO has always been of great importance for astrophysicists as well as for spectroscopists. In the present investigation, we have solved a set of statistical equilibrium equations coupled with the equations of radiative transfer for H_2CO. Since the kinetic temperature in the medium where H_2CO is identified is few tens of Kelvin, we have considered 22 rotational levels of ortho-H_2CO in the ground vibrational and ground electronic

states. The input data required in the present investigation are the radiative transition probabilities and the collisional rates. Using the latest data for radiative transition probabilities and the collisional rates, we have found anomalous absorption of $1_{10} - 1_{11}$, $2_{11} - 2_{12}$ and $3_{12} - 3_{13}$ transitions of ortho-H_2CO.

Detection of ~41 mHz quasi-periodic oscillations in 4U 0115+634 during its outbursts

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Abstract. We report the detection of quasi-periodic oscillations (QPO) at ~41 mHz in the transient high-mass Be/X-ray binary pulsar 4U 0115+634 using data from the Rossie X-ray Timing Explorer (RXTE) observatory. The observations used in the present work were carried out during the X-ray outbursts in 1999 March-April, 2004 September-October and 2008 March-April. The ~41 mHz QPO in 4U 0115+634 was detected in several RXTE observations during the declining phase of its 1999 March-April outburst. However, this QPO was rarely detected during other two outbursts of the pulsar. Though QPOs at ~2 mHZ, and ~60 mHz were already detected in the pulsar, the ~41 mHz QPO was detected for the first time in the pulsar. Simultaneous appearance of QPOs at several frequencies is rarely seen in accretion powered X-ray pulsars. The results of our analysis of RXTE data during three outbursts of the pulsar are presented.

Photometric identification of objects from Galaxy Evolution Explorer Survey and Sloan Digital Sky Survey

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Abstract. Sloan Digital Sky Survey photometric observations have been cross-matched with observations from the Galaxy Evolution Explorer for high-latitude stars in the northern hemisphere (≥75°). This provides a wide range of wavelength coverage from Far Ultra-Violet through the optical spectrum and gives one unique SDSS source for every GALEX source. We discuss a sample of 84,649 point sources in the

north galactic pole (NGP) from this combined database. We made use of Kinney-Calzetti spectral atlas of galaxies in combination with the Castelli & Kurucz Atlas of stellar atmosphere models, in order to create a grid of models that spans a wide range of spectral types for stars and galaxies. This grid was fit to the GALEX and SDSS data and extinctions obtained. In 54,795 (~65%) of the total number of objects in our dataset, the fit was found to be better with the galaxy models than with the stellar models.

Analytic formulas for frequency and size dependence of absorption and scattering efficiencies of astronomical polycyclic aromatic hydrocarbons

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Abstract. The frequency and size distribution dependence of extinction spectra for astronomical silicate and graphite grains was analyzed by us in the context of MRN type interstellar dust models. Analytic formulas for the scattering and absorption spectrum of another important constituent of interstellar dust models, namely, the polycyclic aromatic hydrocarbons (PAHs) are developed in the wavelength range 1000 Å – 22,500 Å and their utility was demonstrated. Relative contribution of the PAHs to extinction vis a vis carbonaceous classical grains has been examined.

Comparison of electron capture and beta decay rates in high temperature environment in explosion of supernova type II

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Abstract. It is generally acknowledged that Type II supernova results from the collapse of iron core of a massive star which, at least in some cases, produces a neutron star. At this stage, the neutrinos are produced by neutronization which speeds up as collapse continues. 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. At this stage, we try to attain the r-process (rapid neutron capture process) path responsible for the production of heavy elements beyond iron, which are otherwise not possible to be formed by fusion reactions. The most interesting evolution occurs as temperature falls from 1010 K to 109 K. At these high temperature conditions, the near critical fluids after fusion reactions transform into the respective atoms by r-process path which on beta decaying produce the ultimate elements of the periodic

chart. Another astrophysical parameter needed for our analysis is neutron number density which we take to be greater than 1020 cm^{-3}. With these, at different entropy environments, we assign the neutron binding energy that represents the r-process path in the chart of nuclides. Along the path, the experimental data of observed elements matches our calculated one. It is found that the dynamical timescale of the final collapse is dominated by electron capture on nuclei and not on free protons. It is also found that the beta decay rates are much higher than the corresponding electron capture rates at the same classical condition.

Timing and spectral studies of Gamma-ray Burst 111228A detected with SWIFT-BAT

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Abstract. We report timing (lag-luminosity relation, energy bands versus lag, flux and luminosity) and spectral studies in the Gamma Ray Burst (GRB) 111228A using data from the SWIFT observatory. The observation used in the present work was carried out in 2011 December 28. We extracted temporal lags by cross-correlating different energy band light curves. Data analysis was performed for all combinations of the standard Swift hard X-ray energy bands: 15–25 keV, 25–50 keV, 50–100 keV and 100–150 keV. The temporal lags between these energy channels are presented as a function of the isotropic peak luminosity of the GRB. The results of our analysis of SWIFT data of GRB111228A are presented.

Influence of external trigger on the formation of low-mass objects in BRCs

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Abstract. We are presenting deep imaging in J,H,K broad band and H2, Brγ narrow band of the fields containing eight Bright Rimmed Clouds (BRCs) to investigate the effects of external influence on the stellar initial mass function (IMF), circumstellar disk fraction among young stars, cloud structure and star formation process. There is strong evidence to suggest that the star formation in a number of BRCs are externally triggered (based on their association with the photon dominated regions and embedded thermal sources). From our deep NIR data along with archival Spitzer data-sets, we have identified more than hundred young stellar sources (YSOs) associated with each BRCs. These identified YSOs will be further used to study the effect massive stars on the star formation processes.

Re-analysis of ASAS3 database – discovery of new variable stars

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Abstract. We have re-analysed the ASAS-3 database of variable stars, using sophisticated data analysis tools like SigSpec combined with cubic spline methods, in order to confirm the true periods. We have found several new variable stars with better periods than the published periods. The new detected period and the corresponding light curve shows that our findings are true.

Pre-main sequence variable stars in young open cluster NGC 1893

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Abstract. We present results of multi-epoch (14 nights during 2007–2010) V-band photometry of the cluster NGC 1893 region to identify photometric variable stars in the cluster. The study identified a total of 53 stars showing photometric variability. The members associated with the region are identified on the basis of spectral energy distribution, J-H/H-K two colour diagram and V/V-I colour-magnitude diagram. The ages and masses of the majority of pre-main-sequence sources are found to be $\lesssim$5 Myr and in the range $0.5 \lesssim M/M_{\odot} \lesssim 4$, respectively. These pre-main-sequence sources hence could be T Tauri stars. We also determined the physical parameters like disk mass and accretion rate from the spectral energy distribution of these T Tauri stars. The periods of majority of the T Tauri stars range from 0.1 to 20 day. We found that the brightness of Classical T Tauri stars is varying with larger amplitude in comparison to weak line T Tauri stars. The amplitude is found to decrease with increase in mass, which could be due to the dispersal of disks of massive stars.

X-ray rotational modulation and coronal abundances of AB Doradus

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Abstract. We present conclusive evidence for rotational modulation of stellar X-ray emission, observed on the young and rapidly rotating K0 dwarf star AB Doradus (HD 36705). We have analysed the 10.7 years data from XMM-Newton satellite. A flip-flop cycle of nearly 5 years in X-ray band similar to optical band appears to be present.

The long term variability is not clear, but it seems to be some variability within this data. Total 82 flares were detected in X-ray band. The decay time τ_d was related to rise time τ_r as $\tau_d \; \alpha \; \tau_r^{0.507212\pm0.07004}$. There is an indication of change in coronal abundances of low FIP elements (<10 eV) during flares. However the change is well within 2σ level.

The first multicolour CCD photometric study of the open cluster Mayer 3

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Abstract. We present the analysis and results of the multicolor UBVRI CCD photometry using Himalayan Chandra Telescope, Hanle combined with the 2MASS JHK values for the open cluster Mayer 3, which has no photometric data published so far. This study is a part of the major project undertaken to provide a better picture of the stellar populations in the Galactic disk, with an aim to obtain the basic parameters of the cluster for the first time. Our photometry covers a sky area of 10×10 arcmin and reaches down to V ∼24 mag. By using the star count method we have estimated the cluster radius as 4 arcmin. We have derived the cluster physical parameters by plotting various CCD's and CMD's combined with the relevant theoretical ZAMS and isochrones. The cluster parameters thus estimated are E(B-V) = 0.8±0.1 mag, $(V\text{-}M_v)_o$ = 12.0±0.2 mag and log(age) = 6.6.

Mining the SDSS database to probe the imprints of the first stars of the Galaxy

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Abstract. We present the chemical abundances of key elements (C and Ba) for about 500,000 stars in the SDSS-DR9 database. These key elements are sensitive to the stellar IMF. The metal poor stars ([Fe/H] <−2.5), of the Milky way halo are formed at very early epoch, where the universe was likely to have polluted by the first generation supernovae. The metal poor low mass stars carry the imprints of the first SNs in their chemical composition. Based on the abundances of the chemical elements, we try to understand the origin of early carbon enrichment and the contribution of pair-instability supernovae in the early Halo. These studies are complementary to the high redshift IGM and SN abundance studies.

Photometry of Delta-Scuti type pulsating components in two eclipsing binary stars

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Abstract. The photometry of eclipsing binary systems having Delta-Scuti type pulsating components, are very important observing targets from the asteroseismological point of view. They allow us for the independent determination of masses and radii of the systemic components. Here, a total of 15 hours of photometric observations of two eclipsing binary systems AB Cas and RZ Cas taken with 104-cm Sampurnanand telescope of ARIES equipped with three channel fast photometer have been presented and discussed. Both binary systems were reported to have Delta-Scuti type components.

Precision radial-velocity measurements on bright Sun-like stars

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Abstract. We at PRL have initiated for the first time in India an Exoplanet search program using the precision Radial Velocity (RV) technique. The program is called PARAS (PRL Advanced Radial-velocity All-sky Search) and consists of a high resolution, optical fiber-fed, cross-dispersed, Echelle spectrograph. The spectrograph works at a resolution (R) of 67000, in the wavelength range of 3700 Å – 8400 Å and is coupled with the PRL Mt. Abu 1.2 m telescope. We present here time series RV measurements on RV standard stars like sigma Draconics, 47 UMa and tau Ceti at 2 to sub-2m/s precision. Thus, in principle PARAS can detect exoplanets of masses down to 10 Earth mass at 0.1AU distances or less around 1 to 0.5 Solar Mass stars. Since many of the bright G and K dwarfs are yet to be surveyed at sub-2m/s RV precision at high cadence, this opens up new science opportunities for highly stabilized high resolution spectrographs like PARAS attached to 1m-class telescopes. The PARAS echelle spectrograph is installed in a temperature controlled chamber (0.03C rms at 25C) and inside a vacuum vessel for both temperature and pressure stability.

Investigation of the behaviour of the eruptive young stellar object V1647 Ori since its outburst in 2008

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Abstract. V1647 Ori is a young eruptive low mass pre-main sequence star that illuminates McNeil's nebula. The object has undergone two outbursts in the recent years - first in November 2003 and the second in mid 2008. While the first outburst lasted for about 2 years before it briefly recovered to its quiescent state, the object is still active since its second eruption in 2008. The nature of the V1647 ori outburst and its similarity with other pre-main sequence eruptive objects, namely FUors and EXors, are still debated. Both types of outburst are thought to be driven by a sudden increase of accretion through a circumstellar disk that feeds through a circumstellar envelope. Follow-up photometric and spectroscopic observations in the near-IR(NIR) JHK bands were being made at Mt. Abu observatory using NICS and NICMOS. The NIR observations taken on several occasions during 2008 to 2012 show mean values of brightness in J, H and K bands of 10.82(sigma=0.146), 9.02(0.189) and 7.58(0.234) mags respectively. During the period, occasional brightening or fading by about 2-3 sigma was also noticed which can be attributed to disk accretion rate variations. The NIR spectra obtained in the K band showed Brackett gamma in emission with non-systematic variability. Our observations indicate slight fading out of V1647 ori during the early part of 2012. Modelling of the spectral energy distribution (SED) in visible to sub-mm region (compiled from archival data) suggests increased disk mass accretion rate as compared to its quiescent state. The model parameters are in good agreement with those derived from observations. These results will be discussed in detail.

A study of outburst ephemeris and burst properties of blackhole candidate 4U 1630-47 with ASM, MAXI and Suzaku data

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Abstract. 4U 1630-47 is a soft X-ray transient which is thought to be a blackhole candidate. This source exhibits quasi-periodic outbursts on time scales of 500-700 days. In addition to the normal outbursts which usually last for a few months, the source displays superoutbursts, lasting for one to two years, seen to recur in every 10-12 years. The outburst ephemeris has been studied previously upto 1996 outbursts. In this work we present the updated ephemeris using 16 years data obtained from All Sky Monitor (ASM) onboard RXTE and one years data from MAXI satellite. The data covers 7 outbursts seen from ASM and one outburst seen by MAXI. We study morphology of each of these outbursts. We find that most of the bursts can be

classified in basic three categories: flat top, FRED (Fast Rise Exponential Decay) and triangular. We also investigate relation between burst properties with quiescent flux level using Suzaku data, a study which has not been done previously.

Extinction maps with UVIT and related work

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Abstract. The Ultraviolet Imaging Telescope (UVIT) is scheduled to be launched as a part of the ASTROSAT satellite. As part of the mission planning for the instrument we have studied the efficacy of UVIT observations for interstellar extinction measurements. We find that in the best case scenario, the UVIT can measure the reddening to an accuracy of about 0.02 magnitudes, which combined with the derived distances to the stars, will enable us to model the three-dimensional distribution of extinction in our Galaxy. The knowledge of the distribution of the ISM will then be used to study distant objects, affected by it. This work points the way to further refining the UVIT mission plan to best satisfy different science studies. In this work, we have created the model SEDs for stars of different spectral types reddened by interstellar dust. The stellar SEDs are based on the model spectra of Castelli and Kurucz (2004), provided as fluxes as a function of temperature. Each spectrum was reddened by an extinction curve, based on the standard Milky Way curve of Draine (2003), and then convolved with the all filter curves to produce a magnitude for each of the 16 bands. We have performed Monte Carlo simulations to estimate the uncertainty expected from the UVIT observations. Each simulation consisted of a series of 100 independent runs for a 20th magnitude star, with different combinations of temperature and E(B-V) with an assumed error of 0.1 magnitudes in each of the bands. We have begun the process of observational mission planning for the UVIT instrument by calculating the flux in each of the UVIT bands to maximize the science. In this work, we describe our plans to make a three-dimensional dust map over the sky using the UVIT point source catalog, combined with GALEX and SDSS observations. We have determined the best filter combination for this extinction work as NUVB5 filter with any of the FUV filter, but since observations are generally serendipitous in nature, we will use all the UVIT data for our purpose. The process of observational mission planning for UVIT will include the optimization of filters combinations for all scientific objectives. For example, we will calculate SEDs for different scientific programs (such as, for eg., stellar astrophysics, observations of globular clusters, AGN, etc.) and select the optimal filters.

High-resolution spectroscopic study of CH stars

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Abstract. Results from a high-resolution spectral analysis of a selected sample of CH stars are presented. Atmospheric parameters - effective temperature, surface gravity, metallicity and elemental abundances of the objects are derived using model atmospheres. Abundance ratios of the heavy elements with respect to Fe, Eu and Ba are estimated. Enhancement of carbon and heavy elements relative to Fe, that are characteristic of CH stars are evident from our analysis. Heavy elements are produced mainly by two nucleosynthesis processes, s-process and r-process. A parametric model based study is conducted to understand the relative contributions from the s- and r-processes to the abundances of the heavy elements.

(C) Extragalactic Astronomy and Cosmology

Spectral studies of some E/S0 galaxies using the SDSS DR7 data

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Abstract. We present spectroscopic analysis of Sloan Digital Sky Survey (SDSS) DR7 data of some early type galaxies in the optical band. Early type galaxies are bulge dominated and spheroidal galaxies, including ellipticals and lenticulars. They have simple morphology and smooth kinematics. These galaxies contain most of the visible mass of the Universe. We have estimated the mass of the central black hole, star formation rate (SFR) and metallicity of NGX 2911, NGC 5525, NGC 7722 and NGC 2534. SFR was calculated using H alpha emission line. Metallicity was calculated using [NII](6853) and H alpha line. We have also examined the relation between the SFR and the H alpha emission line luminosity.

Intrinsic shapes of elliptical galaxy: NGC 1052 using modified prior

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Abstract. Determination of intrinsic shapes of the individual elliptical galaxies using photometry is an important problem because the number of galaxies with good pho-

tometry is many more than those with good kinematics. We determine the intrinsic shapes of the light distribution of elliptical galaxies by combining the profiles of photometric data from the literature with triaxial models. We use ensembles of models so that the shape estimates are largely model independent. We follow the methodology as described in Statler (1994) which is modified to suit our requirements. We find that short to long axial ratios at very small radii and at very large radii, and the absolute value of the triaxiality difference are the best constrained shape parameters. Using a flat prior, the shapes of elliptical galaxies are reported by Chakraborty et al (2008) and Singh & Chakraborty (2009). The flat prior of 20 galaxies are superimposed over EAC-Ph other to obtain the distribution. This distribution is regarded as a prior (a modified prior) and shapes of 20 galaxies are again recalculated by using such modified prior. We determine the intrinsic shapes of the elliptical galaxy NGC 1052 using modified prior should be more reliable. These results are compared with the previous estimates which are determined by using flat prior. The plot shows the intrinsic shapes of the NGC 1052 as a function of $(q0, q\infty)$ for two dimensional shapes and $(q0, q\infty, |Td|)$ for three dimensional shapes, where $q0$ and $q\infty(= q)$ are the short to long axial ratios at small and at large radii and $|Td|$ is the absolute values of the triaxiality difference, defined as $|Td| = |T\infty - T0|$. The probability is shown in the dark gray region: darker is the region higher is the probability. We find that the galaxy NGC 1052 is flatter inside and flatter outside.

Structural decomposition of nearby early-type galaxies with ionized gas

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Abstract. We report morphological analysis of early type galaxies with ionised gas observed in the near-infrared K-band taken from 2MASS (2 Micron All Sky Survey). The sample covers elliptical and lenticular morphological subclasses in low density environments, fraction of galaxies in relatively dense environments. The samples span wide range in central velocity dispersion and have the redshift less than 5500 km/s along with emission lines in their optical spectra. Our sample contained 43 galaxies. We did the profile fitting by 2-dimensional bulge disc decomposition method using the code GALFIT for each galaxy image. The separate bulge and disc structural parameters like the central surface brightness, half light radius, disc scale length and shape parameter were estimated. Using the extracted bulge and disc structural parameters we report scaling relations, which show significant deviations in comparison of coma cluster of galaxies.

Cosmological implications of unimodular gravity

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Abstract. We consider a model of gravity and matter fields which is invariant only under unimodular general coordinate transformations (GCT). The determinant of the metric is treated as a separate field which transforms as a scalar under unimodular GCT. Furthermore we also demand that the theory is invariant under a new global symmetry which we call generalized conformal invariance. We study the cosmological implications of the resulting theory. We show that this theory gives a fit to the high-z supernova data which is identical to the standard Big Bang model. Hence we require some other cosmological observations to test the validity of this model. We also consider some models which do not obey the generalized conformal invariance. In these models we can fit the supernova data without introducing the standard cosmological constant term. Furthermore these models introduce only one dark component and hence solve the coincidence problem of dark matter and dark energy.

Multi-wavelength study of the FSRQ B3 1708+433 in Fermi era

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Abstract. A multiwavelength study of the Flat Spectrum Radio QSO (FSRQ)B3 1708+433 (z=1.027), also known as CGRaBS J1709+4318, is performed during 3.5 years of Fermi-LAT observations. Several GeV gamma ray flares are observed during these observations. We have analyzed and compared these flares to understand the emission mechanism which caused these flares. A significant correlation is observed between the spectral index and flux activity during the flares. An energy dependent flux variability of the source is also studied over this period. The multiwavelength spectral energy distribution of the source is studied to understand more about physical condition of the source.

Multi-wavelength studies of ultra luminous X-ray sources in NGC1427

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Abstract. We present the results on the multi-wavelength studies of point sources and ultra luminous X-ray sources (ULXs) in NGC 1427 using the Chandra, Hubble Space Telescope (HST) and Spitzer missions. NGC 1427 is an elliptical galaxy in Fornax cluster, 13 X-ray sources with net counts >50 have been identified by Chandra observation in 2005. Most of the X-ray sources are well fitted with disk black body than power law model and its X-ray luminosity reaches the ULXs range. We searched for the optical counterparts to these sources in HST archival images and studied the variability. Out of 13 sources, four sources are in the field of view of HST and three of them having potential optical counterparts within less than two arc-seconds. One of the optical counterparts of ULXs exhibits a significant variability of ∼0.3 magnitude between two F475W observations separated by 22 months. While, other counterparts are not variable in the same time scale. Also, these sources are blue in (g-z) colors and their optical luminosity are comparable to the X-ray ones. For some sources, the optical luminosity exceeds the X-ray luminosity. The optical magnitude difference is higher than the reported case of ULXs, indicating that the optical variability connected to the X-ray activity.

Multi-wavelength study of blazar CGRaBSJ0211+1051

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Abstract. While a study of the correlated variations in different wavebands provides important clues to the emission processes responsible for the emissions in AGNs, spectral energy distribution characterizes a blazar giving the position of two peaks. We reported the detection of high and variable optical linear polarization for the blazar candidate CGRaBS J0211+1051, based on which it was proposed to be a low energy peaked (LBL) blazar. In order to confirm this possibility, we analysed the data available in the radio, UV, X-ray and gamma-rays from MOJAVE, Metsahovi observatory (radio), SWIFT (optical, UV and X-ray) and Fermi (gamma-rays) quasi-simultaneous with our own observations made in the R-band using 1kx1k EMCCD mounted at the

50cm telescope dedicated to the variability study (ATVS) at Mt Abu IR Observatory (MIRO). We constructed light curves in various energy bands to study correlated variations and found them to be highly correlated in R, V, B, U, UVW1, X-ray and gamma-rays. The degree of polarization is seen to initially correlate with position angle but anti-correlate February 2, 2011 onwards. The nature of light curves suggest a common origin of emissions at optical, UV and Gamma-rays, most probably near the end of collimation/acceleration zone. The spectral energy distribution constructed from these observations reveals that the synchrotron peak lies in near IR region and that the SED is dominated by high energy emission. This confirms the LBL status of the source and also indicates that extent of polarization can also be used to tentatively classify blazars. The detailed results will be discussed at the conference.

Magnetogenesis in higher dimension Gauss-Bonnet gravity

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Abstract. Origin of cosmological magnetic field is an unsolved problem. There are enough motivations to look into the context of early universe for the origin of magnetic fields. A brief description about such possibilities in higher dimensional cosmological scenarios will be presented. Particularly Gauss-Bonnet gravity in extra dimensions has been considered. A generic solution and scale dependence of power spectrum will be presented as well as the present strength of magnetic field generated through such models will be discussed.

Search for TeV gamma-ray signal from Markarian 421 and M87 using TACTIC observations during 2011-12

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Abstract. We have observed two AGNs M87 (z=0.004) and Markarian 421 (z=0.030) in TeV γ-ray range with the TACTIC telescope located at Mt. Abu, Rajasthan. The observations were made during February 2011 - April 2011 (M87) and January 2012 - April 2012 (Mkn 421) for 49.83 and 104.5 hours respectively. Preliminary analysis of the data recorded does not indicate any presence of a statistically significant TeV gamma-ray signal from either source direction. Detailed data analysis is being done and the results obtained would be presented in the meeting. In addition, data recorded by two satellite based experiments FERMI (LAT) (30 MeV-300 GeV) and

Swift (BAT) (15-50 KeV) on these two AGN are also being analyzed to obtain respective source light curves which would then further be compared with those obtained at TACTIC energies for the same period. These results will also be presented in the meeting.

A study of the environments of large radio galaxies using SDSS

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Abstract. The distributions of galaxies in the environments of 16 large radio sources have been examined using the SDSS.In the giant radio galaxy J1552+2005 (3C 326) which has the highest arm-length ratio, the shorter arm is found to interact with a group of galaxies which forms part of a filamentary structure.In two cases with strong and variable cases, J0313+4120 and J1147+3501, the large flux density asymmetries are possibly also caused by the effects of relativistic motion.

Gamma/Hadron segregation using Random Forest method in ground based Gamma Ray Astronomy: Random Forest Leads

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Abstract. The conventional methods of Gamma/Hadron segregation for ground based Atmospheric Cherenkov telescopes break down below 200 GeV. A machine learning method "Random Forest" is employed for gamma/hadron segregation. Random Forest (RF) is a flexible multivariate selection method which combines 'Bagging' and 'Random Split Selection' to construct a large collection of decision trees and then combines them to construct a common classifier. In this work, we have evaluated and compared various machine learning methods such as Support Vector Machine, Artificial Neural Network, Naive Bayes Classifiers, Standard Discriminant Analysis as well as the conventional dynamic supercut method with the Random Forest method. It is demonstrated that the Random Forest method is the most sensitive machine learning method for γ-hadron segregation in the low energy regime where the upcoming MACE (Major Atmospheric Cherenkov Experiment) telescope will be operational.

Radio continuum emission and HI gas accretion in the NGC 5903/5898 compact group of early-type galaxies

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Abstract. Striking new details of radio emission are unveiled from the 2nd Data Release of the ongoing TIFR.GMRT.SKY.SURVEY (TGSS) which provides images with a resolution of $24'' \times 18''$ and a typical rms noise of 5 mJy at 150 MHz. Previous radio observations of this compact triplet of galaxies include images at higher frequencies of the radio continuum as well as HI emission, the latter showing huge HI trails originating from the vicinity of NGC 5903 where HI is in a kinematically disturbed state. The TGSS 150 MHz image has revealed a large asymmetric radio halo around NGC 5903 and also established that the dwarf SO galaxy ESO514-G003 is the host to a previously known bright double radio source. The radio emission from NGC 5903 is found to have a very steep radio spectrum (alpha -1.5) and to envelope a network of radio continuum filaments bearing a spatial relationship to the HI trails. Another noteworthy aspect of this triplet of early-type galaxies highlighted by the present study is that both its radio loud members, namely NGC 5903 and ESO514-G003, are also the only galaxies that are seen to be connected to an HI filament. This correlation is consistent with the premise that cold gas accretion is of prime importance for triggering powerful jet activity in the nuclei of early-type galaxies.

Primordial nongaussianity from an anomalous potential

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Abstract. Inflationary model driven by a scalar field whose potential has a step in the second order derivative with respect to the field is considered. It is shown that such a feature in the primordial spectrum, if exists at all, should lie on large scales $k_0 \lesssim 0.003$ Mpc^{-1}. For the best fit potential parameter values, the 3-point function and the non-Gaussianity associated with the featured model is calculated. The distinctive feature of this non-Gaussianity is its characteristic ringing behaviour of f_{NL}. We can see that the oscillations in f_{NL} in this model last for a much longer range of k values, as compared to the previously studied models. In that sense, this model is potentially distinguishable from models with other features in the potential.

Study of classical Be-star candidates in different environments

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Abstract. We present a systematic study of classical Be-star candidates in field stars and star clusters. At low metallicity B type stars rotate faster than at higher metallicity. As a consequence large number of Be- stars are expected in the more metal poor Small and Large Magellanic Clouds (S&LMC), when compared to our Galaxy. We studied NIR-optical photometry of nearly 1000 Be star candidates in the LMC and nearly 800 Be star candidates in the SMC by cross correlating OGLE and IRSF-MCPSC databases. Significant number of clusters (10 clusters in the LMC and 9 clusters in the SMC) are also studied. Spectra of 120 stars belonging to the LMC and the SMC and spectra of 118 Galactic Be stars are also analysed to study their spectral properties. Our study points to the fact that the photometric variability followed up with NIR photometry and spectral analysis is a very effective and efficient tool to identify large number of candidate Be stars in external galaxies. This study identifies possible effect of environment, such as density and metallicity, on the properties of the Classical Be star population.

VHE gamma-ray observations of Markarian 501 using TACTIC during April-May 2012

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Abstract. We have observed blazar Markarian 501 (z =0.034) in Very High Energy (VHE) γ-ray range with the TACTIC telescope located at Mt. Abu, Rajasthan (24.6° N, 72.7° E, 1300m asl). The observations were made in tracking mode of the telescope operation during April 15 – May 30, 2012 for 67.8 hours. Preliminary results of data analysis indicate a presence of a VHE gamma-ray signal (404.7±62.6 photons) at 6.47σ level from the source direction above 1 TeV. Further, the source data recorded by satellite based experiments namely; FERMI LAT (30 MeV-300 GeV), Swift XRT(0.3-10 keV) and BAT(15-50KeV) are also being analyzed to obtain source light curves and energy spectrum for the same period in order to investigate source states at lower energies as well. Details of the data analysis results obtained will be presented in the meeting.

Direction dependent power spectrum and its effect in cosmic microwave background radiation

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Abstract. For a statistically isotropic Universe the primordial power spectrum depends only on the magnitude of the wave vector K and independent of its direction. Here we add an anisotropic term to the FRW metric and constructed a direction dependent power spectrum. We study the effect of this power spectrum on cosmic microwave background radiation, explicitly by computing the correlation of power tensor for consecutive multipoles. We find that the lowest multipoles l = 2,3 are highly correlated, and hence explain their observed alignment.

Morphological analysis of nearby elliptical galaxies

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Abstract. We report correlations among bulge-disk parameters for a sample of twenty nearby (<30 Mpc) elliptical galaxies with K band observations from (Two Micron All Sky Survey (2MASS)). The global photometric parameters were extracted using the code "GALFIT" assuming Sersic bulge with an optional exponential disk. The sample contains all elliptical galaxies from Swartz et al. (2004) with identified non nuclear ultra luminous sources (ULXs) with intrinsic luminosities of LX > 10^{39} ergs/s in the 0.5-8.0 keV energy band. Out of 20 galaxies, seven (35%) shows no significant disk component in it. The rest of the galaxies in the sample show significant disk component with a mean B/T ratio 0.29±0.06. No obvious differences were obtained in various two and three parameter correlations with that of Coma cluster ellipticals, even though our sample is from the nearby Universe.

150 MHz TGSS source identifications and its cross matching with other survey

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Abstract. This work presents source identifications in 150 MHz TIFR GMRT Sky Survey (TGSS) and their cross matching (Xmatching) with other survey. A complete automated Xmatching stream line was developed to massively process TGSS data. This produced the scientifically valuable Xmatching results between TGSS and other survey (like NVSS/6dFGS) in a very short time with near to nil manual expenditure

of effort and time. For example, during the time of writing snap shots of all the extended sources in DR4 data release could be sorted out within a few hours along with other Xmatching results (spectral index, redshift availability, number of NVSS components, probable discovery of new sources seen only at 150 MHz etc.) concerning both extended and compact sources. This work presents some of the results obtained using the automated stream line.

Thawing versus tracker behaviour: observational evidence

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Abstract. Several attempts have been made to explain the late time acceleration of the Universe. These include a variety of scalar field models among others. These can be divided into two broad categories, namely the thawing and the tracker classes. We investigate, here, the evidence for these models with the currently available observational data using the Bayesian approach. We use the Generalized Chaplygin Gas (GCG) parametrization for dark energy equation of state (EoS). The reason is that it exhibits both the thawer and tracker like behaviours for different values of the parameters. We have also used the SnIa (SN) measurements, the recent measurements of the Hubble parameter at different redshifts (H(z)), measurements of the lookback time at different redshifts (Lookback) and measurements of the linear growth factor in large scale structure (GR) derived from redshift surveys. We have also used the measurement of the anisotropies in the cosmic microwave background radiation by WMAP-7 observations. The analysis of data from SN+H(Z)+Lookback does not favour either the tracker or thawer classes. If one assumes the dark energy to be a smooth component, inclusion of data from GR+WMAP-7 favours the thawer class of models. However, if we consider the dark energy perturbation, both tracker and thawer type of models are equally favoured by the data.

Suzaku and XMM-Newton view of Mrk 110 and Ark 564

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Abstract. We report on the timing and spectral analysis of Suzaku observations of two Narrow Line Seyfert 1 sources, Ark 564 and Mrk 110 and XMM-Newton observation of Mrk 1040. For Mrk 110 and Ark 564 we have also analyzed the corresponding XMM-Newton observations for comparison. We find that a double Comptonization model explains the soft excess and the high energy continuum for both sources. The

spectra of these two AGN seem to be analogous to the hard and soft states observed in Galactic Black hole binaries. The analogy is further strengthened by the Eddington ratio (in the 0.7-40 keV band) which is ∼0.03 for Mrk 110, similar to that of black holes binaries in the hard state, while for Ark 564 it is ∼0.2 consistent with that of the soft state. However, unlike the soft state of typical black hole binaries, Ark 564 is highly variable with rms increasing with energy. This suggests that the source is more like the soft state of Cygnus X-1, which is also highly variable, although there may be a difference in the bolometric Eddington ratio between the two. Mrk 110 shows significantly lower variability, which is expected due to the large black hole mass $\sim 10^8$ M$\odot$ of the system. We have further investigated the multiple XMM-Newton observations of Ark 564 for the X-ray-optical correlation using data from Optical Monitor and EPIC PN instruments onboard XMM-Newton. We report the presence of soft time lags in the dominant variability timescale of 10^4 s and rms variability in the XMM-Newton observation of Mrk 1040.

Optical study of Type IIb supernovae 2011dh and 2012P

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Abstract. Type IIb supernovae (SNe) exhibits very interesting features in their spectral evolution, viz. the early spectra are dominated by hydrogen lines similar to Type II SNe, but after reaching the maximum light, strong Helium lines start dominating in optical and near-infrared spectra like typical Type Ib SNe. These transitional SNe provide important link between the explosion physics of both Type II and Type I core collapse events. In this study, we present new UBVRI photometric and low resolution spectroscopic observations of two nearby Type-IIb SNe 2011dh in M51 (D ∼ 7.5 Mpc) and 2012P in NGC5806 (D ∼ 25 Mpc) observed from 1m class telescopes at ARIES, Nainital and 2m optical telescope at IGO, Pune. A preliminary analysis of light curves and spectra of these events have been performed. The UBVRI pseudo-bolometric light curve of SN 2011dh is found to be similar to well-studied Type IIb SN 2008ax with peak luminosity $\sim 10^{42}$ erg/s, while the light curve of SN 2012P indicate that it is a sub-luminous Type IIb event. The +53 day spectral features of SN 2012P resembles with other typical Type IIb events. Strong He I P-Cygni features are seen in the spectra with narrow H_α and H_β emission line originating from underlying HII region. Photospheric velocity estimated from He I (5876 Å) feature is ∼ 2700 km/s. A further discussion on the progenitors and environment of SNe shall be presented.

Multi-wavelength variability in FSRQ PKS1510-089

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Abstract. Blazars are subclass of Active Galactic Nuclei, consisting a jet of a highly relativistic plasma very close to our line of sight (≤15 deg). Blazars are well known for non-thermal continuum emission over the entire energy spectrum, i.e ranging from radio to VHE Gamma-Rays through Optical/X-ray energy bands. Blazars broadly comprises the Flat Spectrum Quasars (FSRQs) and BL Lac Objects (BLLacs). The main differences between BL Lacs and FSRQ are, to first order, that the FSRQ are more distant, more luminous, and have stronger emission lines. In the present study we are investigating FSRQ pks1510-089 for variability of all possible time scales in different energy bands and try to get possible connections between Radio to Gamma Rays . The present understanding of energy mechanism in these source strengthen the possibility of some correlation. Monitoring of Jets in Active Galactic Nuclei with VLBI Experiments (MOJAVE) team is regularly monitoring the source in Radio and FERMI/AGILE in Gamma-Rays as well. The published/Archived data for other waveband along-with optical polarization and photometric monitoring data taken from 1.2 m optical telescope at Mt. Abu Infrared Observatory (MIRO) is used for the study. The preliminary results of this study will be presented during the meeting.

The metallicity map of the Large Magellanic Cloud

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Abstract. We have created a metallicity map of the Large Magellanic Cloud (LMC) using the MCPS and OGLE III photometric data. This is a complete first of its kind map of metallicity upto a radius of 4-5 degrees, which will throw light on evolutionary history as well as star formation history of the LMC. We identify the red giant branch in the V, (V-I) colour magnitude diagrams of small sub regions. The slope of the red giant branch in each sub region is estimated, which is an indicator of the mean metallicity of the region. The estimated slope is converted to metallicity using spectroscopically derived metallicities of field red giants near the central region (Cole et al. 2005) and star clusters (Grocholski et al. 2006) in the LMC. From the metallicity map, we estimate the average metallicity of the bar region and the entire LMC. These values are in agreement with previous results obtained for smaller pockets in the LMC. We also study the nature of the metallicity gradient, estimate the mean radial gradient in metallicity and identify locations with significant variation in metallicity.

(D) Instrumentation

High altitude balloon experiments at IIA

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Abstract. Recent advances in balloon experiments as well as in electronics have made it possible to fly scientific payloads at costs accessible to university departments. We have begun a program of high altitude ballooning at the Indian Institute of Astrophysics, Bengaluru. The primary purpose of this activity is to test low-cost ultraviolet (UV) payloads for eventual space flight, but we will also try scientific exploration of the phenomena occurring in the upper atmosphere, including sprites and meteorite impacts. We present the results of the initial experiments carried out at the CREST campus of IIA, Hosakote, and describe our plans for the future.

HESP: Instrument control, calibration and pipeline development

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Abstract. Hanle Echelle SPectrograph (HESP) is a fibre-fed, high resolution (R = 30,000 and 60,000) spectrograph being developed for the 2m HCT telescope at IAO, Hanle. The major components of the instrument are a) Cassegrain unit b) Spectrometer instrument. An instrument control system interacting with a guiding unit at Cassegrain interface as well as handling spectrograph functions is being developed. An on-axis auto-guiding using the spill-over angular ring around the input pinhole is also being developed. The stellar light from the Cassegrain unit is taken to the spectrograph using an optical fiber which is being characterized for spectral transmission, focal ratio degradation and scrambling properties. The design of the thermal enclosure and thermal control for the spectrograph housing is presented. A data pipeline for the entire Echelle spectral reduction is being developed. We also plan to implement an instrument physical model based calibration into the main data pipeline and in the maintenance and quality control operations.

Limiting magnitude of hypertelescopes

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Abstract. Optical stellar interferometers have demonstrated milli-arcsecond resolution with few apertures spaced hundreds of meters apart. To obtain rich direct images, many apertures will be needed, for a better sampling of the incoming wavefront. The coherent imaging thus achievable improves the sensitivity with respect to the incoherent combination of successive fringed exposures, heretofore achieved in the form of optical aperture synthesis. For efficient use of highly diluted apertures, this can be done with pupil densification, a technique also called "Hypertelescope Imaging". Using numerical simulations we have found out the limiting magnitude of hypertelescopes over different baselines and pupil densifications. Here we discuss the advantages of using hypertelescope systems over classical pairwise optical interferometry.

A radiation spectrometer for planetary missions

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Abstract. This is an instrument designed to monitor the radiation environment in space by measuring the energy, flux and dose of the incident charged particles, besides carrying out particle identification by the well established "$E - \Delta E$ technique". The radiation environment in space is mainly made up of background Galactic Cosmic Radiations (GCR) punctuated by brief but intense Solar Particle Events (SPEs). Information about this radiation environment is an important input to plan, design long duration satellite and execute human exploration missions. We are in the process of building a compact radiation spectrometer. The lab model development for this instrument is under progress. Here we present the performance of the lab model detector and electronics which is validated through GEANT simulations. This instrument can be flown on future inter-planetary missions for carrying out radiation environment related studies.

Development of a lunar scintillometer for measuring ground layer turbulence

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Abstract. Ground layer turbulence is one of the important site characterization parameters used for assessing the quality of an astronomical site. Lunar Scintillometer (LuSci) is a simple, yet an effective site-testing device for measuring the ground layer turbulence. The instrument consists of a linear array of photodiodes which record the variations in moon's intensity caused by the lower layers of the Earth's atmosphere. The covariance between all possible pairs of photodiodes can be used to reconstruct the ground layer turbulence profile from the ground up to a maximum height roughly determined by the distance between the furthest pair of detectors. The 6-channel LuSci that we have developed at Indian Institute of Astrophysics is closely based on a similar Instrument recently built by the team led by Andrei Tokovinin of CTIO, Chile. We intend to use this device with other site-testing instruments such as Multi Aperture Scintillation Sensor (MASS) and Differential Image Motion Monitor (DIMM), which are at different stages of development. In this work, we present the details of hardware design, signal acquisition and inversion techniques used to retrieve the relevant parameters of the atmosphere. Some preliminary results from the on-site measurements and laboratory tests will also be described.

Geoneutrinos, Earth's heat budget and neutrino tomography of Earth

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Abstract. (1) We examine relevance of KamLAND and Borexino geoneutrinos (of few GeV energy) for Earth's heat budget. Radiogenic heat is half the total measured from Earth to space. The rest must come from heat slowly dissipating after solidification of Earth. A limit can also be put on any nuclear reactor in Earth's core. Better statistics of geoneutrinos will tighten this limit, perhaps to zero, as geophysics indicates. (2) Of scenarios for Earth's tomography using neutrinos, oscillation tomography using solar neutrinos is most promising. Use of neutrinos from accelerators or reactors for this needs reduction of errors to ppm level, as Earth's matter affects neutrinos only at 0.1% level. Absorption tomography using cosmic 10 to 10000 TeV neutrinos is promising, but for the far future, as cubic kilometre size detectors are needed. This is only a brief review that touches on selected aspects.

Instrumentation for observation of low frequency radio emission from the Sun and Jupiter

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Abstract. Spectral observations of the solar corona in the frequency range 30 kHz–14 MHz are carried out using space-borne instruments, while the ground-based observations are carried out in the frequency range from 40–120 MHz. The ionospheric cut-off frequency (for ground-based observations) at Gauribidanur goes down up to 10 MHz at times. Taking advantage of this we wanted to explore the possibility of carrying out radio observations of the solar corona in the frequency range 10–40 MHz which will bridge the existing gap between ground- and space-based observations. Note that intense radio emission from Jupiter also occurs predominantly at low frequencies (15-40 MHz). Development of an antenna system and backend instruments for regular observation of radio emission coming from the Sun and Jupiter in the frequency range from 10-40 MHz has been planned and is being carried out.

Preliminary optical design of ARIES-High Resolution Echelle Spectrograph

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Abstract. For the upcoming 3.6m telescope a High Resolution Echelle Spectrograph is being envisaged as the key instrument to meet wide range science goals namely, asteroseismology, exoplanet search, doppler imaging of spotted stars, massive stars, colliding wind binaries and abundance studies etc. These objectives, in turn, result in a series of technical requirements e.g. spectral coverage of 300 nm to 900 nm, spectral resolution ~60,000, radial velocity stability < 20 ms^{-1} etc. In addition, a temperature controlled environment and flexible but robust operation is also required. The preliminary optical design of the ARIES-High Resolution Echelle Spectrograph (ARIES-HIRES) is based on the white pupil concept. It is a fiber fed spectrograph, which converts F/9 beam from the telescope to F/3.6. An image slicer would be used to slice the image of the fiber exit to achieve high spectral resolution. The use of intermediate folding mirror makes the instrument more compact. Prisms have been used as cross dispersers to achieve more uniform inter order separation. Simultaneous wavelength spectrum would be used to correct the instrument drift. The spectrograph will be mounted on the vibration isolation table kept inside the telescope pier in an isolated environment. The acquisition and guiding unit, atmospheric dispersion corrector, and calibration unit will be part of the instrument.

A preliminary scheme to modify the reception characteristics of a log-periodic antenna within its operating bandwidth

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Abstract. The level of radio emission from the Sun and other celestial sources that we receive on the Earth is very low when compared to those generated here (e.g. by TV and radio broadcasting stations, engines of automobiles and industrial equipment). Therefore, it requires technically advanced systems to detect those weak emissions in order to study their characteristics, generation mechanisms, etc. - one of the interests of human race to enhance its knowledge about space and its entities. Although inevitable and became part of life, the civilian radio broadcast, communication networks are capable of affecting such observations directly. Studies show that eliminating such interferences at an early stage improves not only the analyses but also the reliability of the results. Towards this an attempt is made to alter the characteristics of an antenna since it is the foremost component of any radio receiver system. The tests are made with a Log-periodic dipole antenna (LPDA) and the changes in the reception characteristics over a few set of undesired frequency bands are discussed here.

Compton polarimeter as a focal plane detector for hard X-ray telescope

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Abstract. X-ray polarimetry is expected to provide unique opportunity to study the behavior of matter and radiation under extreme magnetic fields and extreme gravitational fields. However sensitivity of the X-ray polarimeters has always been an issue for the last three decades; there is almost no progress in this field whereas there is a significant advance in the fields of X-ray spectroscopy, imaging and timing. Recently significant improvement in the sensitivity is expected in polarimetric measurements using GEM-based photoelectron tracking polarimeters coupled to soft X-ray telescopes. However they are sensitive in the soft X-ray regime. On the other hand mostly for the X-ray sources higher degree of polarisation at hard X-rays is expected because of the dominance of nonthermal X-ray emission mechanisms over the thermal counterpart. So polarisation measurement in hard X-ray can yield significant insights into such processes. Of late with the advent of high energy focussing telescopes (e.g. Nu STAR, ASTRO-H), sensitivity of X-ray detectors in hard X-ray range is expected to improve significantly. In this context we explore feasibility of a focal plane hard X-ray polarimeter based on Compton scattering having a thin plastic scatterer surrounded by cylindrical array of scintillator detectors. We have carried out detailed Geant4 simulations to estimate the modulation factor for 100% polarized

beam as well as polarimetric efficiency of this configuration. Polarimetric sensitivity of the instrument critically depends on low energy threshold in central plastic scatterer. We estimated the sensitivity for a range of plastic threshold energy. We also discuss the methodology to measure the threshold energy in plastic scatterer. Here we present the initial results of polarisation sensitivities of such focal plane Compton polarimeter coupled with the reflection efficiency of present era hard X-ray optics and the experimental results for threshold measurements in plastic.

Automated extinction monitor for the NLOT site survey

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Abstract. In order to search a few potential sites for the National Large Optical Telescope (NLOT) project, we have initiated a site survey program. Since, most of instruments used for the site survey are custom made, we also started developing our own site characterization instruments. In this process we have designed and developed a device called Automated Extinction Monitor (AEM) and installed the same at IAO, Hanle. The AEM is a small wide field robotic telescope, dedicated to record atmospheric extinction in one or more photometric bands. It gives very accurate statistics of the distribution of photometric nights. In addition to this, instrument also provides the measurement of sky brightness. Here we briefly describe overall instrument and initial results obtained.

Calibration data Analysis Package (CAP): An IDL based widget application for analysis of X-ray calibration data

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Abstract. An IDL (interactive data language) based widget application developed for the calibration of C1XS (Narendranath et al., 2010) instrument on Chandrayaan-1 is modified to provide a generic package for the analysis of data from x-ray detectors. The package supports files in ascii as well as FITS format. Data can be fitted with a list of inbuilt functions to derive the spectral redistribution function (SRF). We have incorporated functions such as 'HYPERMET' (Philips & Marlow 1976) including non Gaussian components in the SRF such as low energy tail, low energy shelf and escape peak. In addition users can incorporate additional models which may be required to model detector specific features. Spectral fits use a routine 'mpfit' which uses Leven-Marquardt least squares fitting method. The SRF derived from this tool can be fed into an accompanying program to generate a redistribution matrix file (RMF) compatible with the X-ray spectral analysis package XSPEC. The tool provides a user friendly interface of help to beginners and also provides transparency and advanced features for experts.