ABSTRACT BOOK

An International Conference on

EXPLORING THE UNIVERSE: NEAR EARTH SPACE SCIENCE TO EXTRA-GALACTIC ASTRONOMY

(A tribute to Professor S. N. Bose on his 125th Birth Anniversary)

S N BOSE NATIONAL CENTRE FOR BASIC SCIENCES

KOLKATA, INDIA

14-17 NOVEMBER, 2018

PLENARY TALKS

PLENARY TALK

High Energy Astrophysics: AstroSat and Beyond

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ABSTRACT

Recent results from AstroSat, India's first multi-wavelength astronomical observatory, will be presented and its impact on High Energy Astrophysics will be reviewed. New developments in this area including X-ray timing and polarisation measurements, that are likely to make impact in the near future are discussed.

PLENARY TALK

Exploring the space with vacuum-ultraviolet radiation

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ABSTRACT

Vacuum-ultraviolet (VUV) spectroscopy and photochemistry of interstellar molecules and materials in gaseous and condensed states attract much interest recently. The information yields detailed knowledge about chemical transformations in astro-environments and can be reconciled to the observations in space. For this purpose, we have performed experiments of spectroscopy and photochemistry using VUV light conducted from a storage ring at National Synchrotron Radiation Research Center (NSRRC) in Taiwan. Taking the advantage of the unique property of synchrotron, we are exploring the VUV spectroscopy and photochemistry for interstellar molecules and materials with exciting prospects. In this presentation, we will discuss the VUV spectroscopies and photochemical processes of interstellar molecules containing N_2, O_2, HCl, H_2O, CH_4, C_2H_2 and NH_3. These investigations improve our understandings of the transformations of chemical species and open windows for perceptions of the mechanisms in space. In addition, we will present the first direct experimental evidence that diamond nanoparticles containing nitrogen-vacancy (NV) defects are capable of emitting red photons upon exposure to VUV radiation. The knowledge is crucial for the identification of NV as the carrier of extended red emission (ERE) bands detected in diverse astrophysical environments. Our results provide strong evidence that nanodiamonds are a major component of cosmic dust in the interstellar medium.

PLENARY TALK

Research on space science using balloon platforms

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ABSTRACT

The Balloon Facility of Tata Institute of Fundamental Research (TIFR-BF) was established in December 1970 at Hyderabad. This is the only major balloon facility in the world close to the geomagnetic equator. Since its inception, the TIFR-BF has been launching zero pressure scientific balloons every year for the study of various scientific applications especially in the field of X-ray & Infrared Astronomy, Astrobiology, High Energy Physics and Atmospheric Science. The large variety of science disciplines studied using scientific balloons include the study of the Sun, the near Earth space environment - ionosphere, magnetosphere, aerosol research, space plasma and its physics & chemistry, interstellar dust and cosmic ray particles. A unique feature of the TIFR-BF is that it has all aspects of Scientific Ballooning i.e. Balloon Design, Fabrication, Payload Integration with Telemetry, Telecommand and other instrumentation, and finally Balloon Launch, Tracking, Data Collection, Balloon Flight Control, as also Payload Recovery, under one roof. The balloon production at the facility is completely indigenous, i.e. balloon material, load tapes, end fittings, bonding tape have been developed in-house. In recent times, the TIFR-BF also designed and fabricated a balloon with carrying capacity of 3 ton with 4 layers of 25 microns, and also oblate spheroids of volume ranging from 10 m^3 to 100 m^3 for testing of newly developed satellite payloads in laboratory at different conditions. The balloon flight support instrumentation at the TIFR-BF has been regularly updated with several innovations and advanced instrumentation for safe and highly reliable flights. A continuous improvement in balloon flight support instrumentation by the Control Instrumentation Group to keep in pace with the growing complexities of the scientific payloads have contributed to the total success of balloon flights conducted recently. In this talk, I will present the details of the above mentioned developments and the future up-gradation plans.

PLENARY TALK

Microwave and Shock Wave Experimental and Computational Studies on Astrochemistry

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ABSTRACT

We have established two experimental laboratories at the Indian Institute of Science. A home built molecular beam microwave spectrometer is used to record the microwave spectrum of molecules and complexes. While our primary objective in these studies were fundamental understanding of intermolecular bonding, some of the examples chosen, such as phenylacetylene and propargyl alcohol are potential astromolecules, yet to be observed. A single pulse shock tube facility has been established with the primary objective of high temperature chemical kinetics studies. Recently, this has been used to study the reaction between C atom and H_2 molecules exposed to a shock wave, under astrophysical conditions. Our main objective was to explore the mechanism of chemical reactions leading to the formation of small and large hydrocarbons. Computational chemistry has been extensively used to help in enhancing our understanding about the origin of astromolecules. Recently, we have proposed the Energy, Stability and Abundance (ESA) principle for astromolecules. This talk will summarize results from both experimental laboratories and highlight how computational chemistry has helped.

PLENARY TALK

Supernovae and progenitors

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ABSTRACT

Supernovae mark the end of a star's life and as such are important probes to study the evolution of a star. With advancement in the development of observing facilities over the past decade and a half and the discovery of several supernovae at intermediate redshifts the studies of supernovae have gained importance as they have been found to be excellent cosmological probes, particularly supernovae of type Ia. The discovery of several bright supernovae in the recent past has enabled detailed studies of these objects, which have revealed the rich diversity in these seemingly similar objects. The observed diversity may be attributed to the properties of the progenitor and also the Environment. In this talk, I will discuss, the properties of supernovae, type Ia in particular, and also one class of possible progenitors, the nova systems.

PLENARY TALK

Strong shock wave in the expanding universe

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ABSTRACT

Self-similar solution is obtained for propagation of a strong shock, in a flat expanding dusty Friedman universe. Approximate analytic solution is obtained [1], using relation between self-similar variables, equivalent to the exact energy conservation integral, which was obtained by L.I. Sedov for the strong explosion in the static uniform medium. Numerical integration of self-similar equation gives an exact solution of the problem, which is rather close to the approximate analytic one [2]. The differences between these solutions are most apparent in the vicinity of the shock. For polytropic equation of state, self-similar solutions exist in more narrow interval of the adiabatic power than in the static case. Dependence of the density, and velocity of the polytropic gas behind the shock wave on time and radius are obtained. The velocity of the shock in the expanding medium decreases as $\sim t^{-1/5}$ slower than the shock velocity in the static uniform medium $\sim t^{-3/5}$, and its radius increases $\sim t^{4/5}$, more rapidly than in the uniform non-gravitating medium $\sim t^{2/5}$. So, the shock propagates in the direction of decreasing density with larger speed, than in the static medium, due to accelerating action of the decreasing density, even in presence of a self-gravitation.

1. G.S. Bisnovatyi-Kogan (2015) Gravitation and Cosmology, Vol. 21, No. 3, pp. 236-240.
2. G.S. Bisnovatyi-Kogan and S.A Panafidina (2018) (submitted).

PLENARY TALK

Imaging Black Holes now and in the future

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ABSTRACT

One of the most fundamental predictions of general relativity are black holes. Their defining feature is the event horizon, the surface that even light cannot escape. So far, we have never seen the event horizon, but this is about to change. Advanced computer simulations make clear predictions of how the shadow of black holes should look like and global interferometric radio observations with the Event Horizon Telescope are now trying to image the supermassive black hole in the center of our own Milky Way and the radio galaxy M87 for the very first time. To improve the imaging quality further more telescopes should be added to the array, in particular in Africa. The more distant future will belong to higher frequencies and space-based interferometry. The talk will give an overview of the ongoing research to image and simulate black holes, as well as of plans for future expansions.

PLENARY TALK

Search for Serendipitous Trans-Neptunian Object Occultation in X-Rays

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ABSTRACT

Small Trans-Neptunian Objects (TNOs), of kilometer size and below, are too dim to observe directly. Observations of serendipitous occultation events caused by these small TNOs provide a way to study their population properties such as the size distribution. Limited by the effect of diffraction, optical occultation events can be used to explore TNOs only down to kilometer size, while with X-ray ones it can be pushed down to about 30 meters. In this talk I will report our efforts and results of using Rossi X-ray Timing Explorer (RXTE) observations in this endeavor. With the same technique, we also obtained observational constraints to the size distribution of small Oort Cloud Objects without any model assumptions. Feasibilities of observations using facilities like ASTROSAT/LAXPC, eXTP/LAD and Athena/WFI will be discussed.

PLENARY TALK

A mysterious glow in the Galactic poles

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ABSTRACT

In many ways, the diffuse radiation at the poles is difficult to understand because the Galactic contribution is at a minimum and the extragalactic radiation is at its strongest, relative to the overall contribution. However, because there is not much dust and the dust is optically thin, modeling the dust scattering is straightforward and can even be done using a single scattering model. I have used GALEX archival data to track the different components finding that the dust contribution is about 30% of the total. I will discuss the other contributors and what the radiation tells us about the UV background at the Galactic poles.

PLENARY TALK

Six decades of Very Low Frequency research activities at CRAAM/Brazil

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ABSTRACT

Very Low Frequency research activities began in Brazil at the end of the fifites. At this time and during two decades or so, most of the research concentrated in getting indirectly physical information of X-ray flares (spectra, intensity) through the extra ionization this radiation produces in the lower ionosphere. In addition, there were case studies on the variability of cosmic sources using the VLF technique. At this time, the technique used an AbsPAL system to record phase and amplitude of VLF waves emitted by man-made transmitters. Later on, with the development of Software Defined Radio systems, VLF research activities in Brazil used the SoftPAL system, as well as systems used by the VLF group in Stanford. This was the epoch of participation in the AWESOME network, and of the development of the South America VLF Network in the region. From then, and also because of the multiplication of UV/EUV, X-ray and Gamma-ray sensors in space, much more comprehensive and quantitative studies of the transient and long-term solar activities as well as impulsive cosmic bursts became possible. Lately, attention was also given to seismic-electromagnetic effects from the remote sensing of the lower ionosphere, which led to promising results indicating that such kind of research deserves further development.

PLENARY TALK

Lessons from GW170817 / GRB170817A

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ABSTRACT

The first detection of a gravitational wave signal from a binary neutron star merger, GW 170817, was also promptly accompanied by an electromagnetic counterpart in the form of a short duration gamma-ray burst, GRB 170817A. A huge global effort of multi-wavelength follow-up observations has led to the detection of kilonova emission in the optical, UV and NIR, as well as long-lived X-ray to radio afterglow emission. This unique event has a wide range of implications ranging from constraints on the neutron star equation of state and maximal mass, through the important role of such binary mergers in r-process nucleosynthesis in the universe, to the type of remnant that was produced, and the properties of the outflows that are produced in these mergers. This talk will focus on what can be learned from this event about the properties of the outflow that powered the prompt gamma-ray emission and the afterglow emission, and briefly outline the constraints on the type of compact remnant (black hole or massive neutron star) that was left in its aftermath.

PLENARY TALK

A Census of Planets in the Milky Way

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ABSTRACT

Our understanding of planetary systems around other stars has undergone a profound shift in the past few years. However, almost all the extra-solar planets discovered so far have been relatively nearby --- within ~500 parsecs from the Sun. In addition, all the planets discovered so far have been relatively close to their parent stars. Are planets equally common around stars in the far reaches of the Galaxy? And, are they common at large orbital distances from their parent stars? This talk will focus on insights into these questions, with special emphasis on results from microlensing and transits. The microlensing follow-up programs mainly use a network of 1-meter class telescopes to monitor ongoing microlensing events to search for planets around the lensing stars. This has led to the detection of several planets, ranging from Earth-like to Jovian planets, some of them far from their parent stars. A transit study that was specifically designed to provide answers to the above questions is the SWEEPS program, which used the Hubble Space Telescope to look for planets around stars in a completely different part of the Galaxy, the Galactic Bulge. This led to the detection of 16 candidate planets through their transit signals, two of which could be confirmed through radial-velocity measurements. The inescapable conclusion is that there must be at least 100 billion planets in the Galaxy, earth-like planets being more common than their more-massive counterparts. The talk will end on possible techniques to detect planets beyond the Milky Way, and some speculative notes on their frequency.

PLENARY TALK

X-ray spectral index correlations vs mass accretion rate in neutron star and black hole X-ray binaries in their different spectral states. Theory vs observations

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ABSTRACT

I present details of observations of neutron star (NS) and black hole (BH) binaries and the first principle theory of X-ray spectral formation in neutron star (NS) and black hole (BH) there. I show that this model predicts the spectral index correlation vs mass accretion rate as in the case of NS as well in the BH case. In BHs the spectral index should increase and then saturate with mass accretion rate because the index as an inverse of Comptonization parameter Y and Y-parameter saturates with the high mass accretion rate in the converging flow onto BH. Comparison of this model prediction with X-ray observations shows that in a BH case the index, indeed, correlates and then saturates with mass accretion rate. Moreover this index-mass accretion rate correlation allows us to estimate BH masses and distance to the source. While in NS sources the observations show that the index stays the same independently of spectral state of the source which can be possible if the energy release in the disk is always much smaller of that at NS Transition Layer (boundary layer).

PLENARY TALK

Role of Indian Observatories in Exploring the Universe

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ABSTRACT

The new / improved facilities for observational astronomy in the country will be reviewed vis-a-vis the corresponding international scene. The anticipated impact of next generation instruments currently under development in India will also be described in the context of their science potential.

PLENARY TALK

Interstellar molecules at low metallicity explored through observations extragalactic star-forming regions

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ABSTRACT

Chemical properties of interstellar molecules in low metallicity environments are crucial to understand chemical processes in the past universe where abundances of heavy elements were significantly lower than the present solar metallicity. Astrochemical observations of interstellar molecules in low metallicity galaxies have recently made great progress. Nearby low-metallicity star-forming galaxies in the Local Group, such as the Large and Small Magellanic Cloud (LMC/SMC) or IC10, have been playing a central role in understanding of low-metallicity interstellar medium. New observational results on various interstellar molecules are reported for molecular clouds in the LMC (e.g., Nishimura et al. 2016a; Paron et al. 2016) and in other low metallicity dwarf galaxies (e.g., Buchbender et al. 2013; Nishimura et al. 2016b; Braine et al. 2017). Cold molecular gas associated with a compact molecular cloud core is spatially resolved in the SMC (Shimonishi et al. 2018b). Emission from warm and dense molecular gas associated with hot molecular cores are detected in the LMC (Shimonishi et al. 2016b; Sewilo et al. 2018). Besides gas-phase species, infrared observations have revealed chemical compositions of ices associated with deeply embedded high-mass young stellar objects in the LMC (e.g., Seale et al. 2011; Shimonishi et al. 2016a) and in the SMC (e.g., Oliveira et al. 2013). Furthermore, from the theoretical viewpoint, numerical simulations on gas-ice chemistry dedicated low-metallicity star-forming regions are reported (Acharyya and Herbst 2015, 2016, 2018; Pauly and Garrod 2018; Ceccarelli et al. 2018). In this talk, I will review recent observational studies on molecular gas and ices in nearby low-metallicity galaxies, and discuss the impact of decreased metallicity on chemical properties of star-forming regions.

INVITED TALKS

INVITED TALK

Triggered star formation in H II regions

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ABSTRACT

It is now well established that massive stars in star forming regions can trigger next generation of star formation. Theoretical simulations suggest two main processes for triggered star formation; the radiation driven implosion (RDI) process and collect & collapse (CC) process. In this talk I will discuss observational aspects of triggered star formation scenario. We are pursuing multiwavelength observations of the Auriga star forming region. Using the multiwavelength observations of the region we have identified young stellar objects (YSOs) down to 0.9 solar mass. The nature of the identified YSOs and their spatial distribution are used to study the star formation scenario in the region. The distribution of the YSOs along with that of the ionized and molecular gas reveals two ring-like structures stretching over an area of a few degrees in extent, suggesting triggered star formation. Majority of the younger population having ages $\sim$ 1 Myr are found to be located at the periphery of the bubbles, suggesting that these could be the third generation stellar population of the region.

INVITED TALK

Blazar OJ287 and its nano-Hertz GW emitting massive BH binary central engine

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ABSTRACT

Blazars are active galactic nuclei with strong jets. They tend to exhibit dramatic and unpredictable flux variations, namely outbursts. Certain observed outbursts from an exceptional Blazar OJ287 can be explained by invoking a massive black hole binary as its central engine. Detailed General Relativistic modeling allowed us to predict a major optical outburst during November 2015. The outburst did occur within the expected time range, peaking on 5/12/2015. A multi-wavelength observational campaign confirmed the occurrence of certain impact flare and the presence of a major thermal component in the flare, as predicted. These observations and subsequent analysis allowed us to establish the presence of a spinning supermassive black hole binary that spirals in due to the emission of nano-Hertz gravitational waves in the central engine of OJ287. I will briefly list our on-going efforts that should be interesting to the Event Horizon Telescope consortium and the International Pulsar Timing Array.

INVITED TALK

Ionospheric Variability: Source Apportionment

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ABSTRACT

Ionosphere has implications in the field of navigation and communication because of its effects on radio propagation due to the presence of free electrons and ions.The primary source of its ionization is the electromagnetic radiation from the Sun. However, Sun has a peculiar spectrum; 90% of its flux (visible and infrared) remains nearly constant, while 10% of the flux (UV, EUV and X-ray) exhibits large variations. These variations in the flux can be either periodic or transient, leading to Space climate and Space weather of the planetary space environment, respectively.Ionosphere is therefore not constant, it shows normal hour-to-hour, day-to-day, 27-day and 11-year variation. Apart from solar and geomagnetic variations, meteorological and lithospheric phenomena are also found to perturb the ionosphere.Many precursors to earthquakes have been reported from time to time,1however, the search for a reliable precursor is still need of the hour. Ionospheric anomaly as one of the earthquake precursors was first reported by Antselevich (1971). Many lithosphere-atmosphere-ionosphere coupling mechanisms have been formulated since then, resulting in ionospheric variability prior toearthquakes which at times is even comparable to other known sources (Gupta & Upadhayaya, 2017). In this study we have examined the anomalous ionospheric signatures prior to major earthquakesduring 2015 to 2018 affecting low-mid latitude Indian station Delhi (28.6°N, 77.2°E, 19.2°N geomagnetic latitude, 42.4°N dip), by using F2 layer critical parameters (foF2, hmF2) obtained every 5 minutes from Digisonde installed at CSIR-New Delhi. The results will be discussed.

INVITED TALK

Multi-wavelength Variability and QPOs in Blazars

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ABSTRACT

Blazar is a sub-class of radio-loud AGN which emit radiation in the complete EM spectrum. Blazars show flux, spectral and polarization variability and emission being pre-dominantly non-thermal. In the present talk, I will review our recent results based on multi-wavelength blazar variability and QPO detection using large number of ground and space based telescopes around the globle.

INVITED TALK

Infrared spectra of interstellar PAH variants

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ABSTRACT

The widespread presence of Polycyclic aromatic hydrocarbon (PAH) molecules in the interstellar medium (ISM) is attested by the observations of strong emission features at 3.3, 6.2, 7.7, 8.6 and 11.2 μm towards astrophysical environments not only in the Milky Way but also in external galaxies (Tielens et al. 2008). The recent confirmation of the presence of fullerene cation in the ISM (Campbell et al. 2015) strongly supports the presence of PAHs. Owing to harsh interstellar conditions, PAHs are subject to physical and chemical processes that bring about changes in the PAH structure. Ionization, dehydrogenation, addition of foreign atoms (for eg., deuteration, nitrogenation, etc.), etc. produce spectral signatures that are being searched for observationally and spectroscopically. In this talk we present recent results on deuterated PAHs and dehydrogenated PAH anions. Deuterated PAHs have been suggested as repositories of missing deuterium in the ISM (Draine 2006). We discuss the probable formation mechanisms and spectral signatures of deuterated PAHs. We explore the feasibility of the existence of deuterated PAHs through the D/H ratio in PAHs of varying sizes (Buragohain et al. 2015). We have theoretically calculated the IR spectra of dehydrogenated PAH anions. Dehydrogenated PAH anions may contribute to spectral features originally thought to be coming only from neutral PAHs and PAH cations especially the features near the 3.3 μm region. Unique features at 5.2 and 5.8 μm are observed for a dehydrogenated PAH anion that arise due to the stretching of the free C-C/C-C-C stretch. These features may be used to identify dehydrogenated PAH anions in the ISM (Buragohain et al. 2018). Experimental spectroscopy in conditions close to that of ISM is desired to concretize our results.

References:
Buragohain et al., 2015, MNRAS, 454, 193
Buragohain et al., 2018, MNRAS, 474, 4594
Campbell et al., 2015, Nature, 523, 322
Tielens A.G.G.M., 2008, ARA&A, 46, 289

INVITED TALK

Astrochemical modeling in explaining observational aspects

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ABSTRACT

Study the formation of star is immensely important as this hold the clue to the origin of our presence in the Universe. Various evolutionary stages of the star formation could well be probed with the observation of various molecules. It is a long-standing aspiration to use chemical properties of interstellar species to measure the physical properties of the ISM. Interpretation of the observed spectral properties reveals the existing physical conditions (density, temperature, ionization degree etc.) of the ISM. An accurate knowledge of the degree of ionization of the interstellar medium is essential since it controls the coupling of the cloud with the galactic magnetic field which affects the star formation rates. In the present data-rich era of modern radio and infrared line observations, I would like to present a coupled chemical and physical model (i.e., Astrochemical model) to explain some of the observational aspects.

INVITED TALK

Timing and Spectral variabilities in Black Holes

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ABSTRACT

Timing and spectral variabilities observed in Black Hole X-ray binaries are important measure to probe the accretion dynamics. We will highlight interesting results from several Black Hole sources observed with various space-based observatories including AstroSat.

INVITED TALK

Super massive black hole demographics

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ABSTRACT

We study seed mass and spin distributions of super massive black holes from direct collapse of super massive disks, primordial black hole seeds and from other scenarios like super massive stars and halo mergers. We predict the evolution of these seeds and their distributions using a relativistic evolution of growth by mergers, gas accretion and stellar ingestion. Recent observations and statistics from tidal disruption events will help in estimating the mass distributions.

INVITED TALK

Understanding Universe with Metal Poor Stars

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ABSTRACT

Metal-poor stars that are long-lived, low-mass objects preserve in their atmospheres the chemical signatures of the gas from which they formed. Studies on the surface chemical composition, abundance ratios and abundance patterns of the old metal-poor stars thus contribute to our understanding of the astrophysical conditions and nucleosynthetic history of the earliest time. The fossil record of the Galactic metal-poor stars provide unique insight into the underlying astrophysical processes involved in the Galaxy formation and Galactic chemical enrichment and complement study of galaxy formation at high-redshift. Recent results from studies on metal-poor stars and some current issues will be discussed.

INVITED TALK

Space Situational Awareness and Space Weather Effects

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ABSTRACT

Space Situational Awareness (SSA) is increasingly becoming relevant to the satellite systems and services community as the number of users of space increases. One of the major challenges to space-based infrastructure is posed by the threat of collision with controlled as well as uncontrolled space objects, both natural and man-made. Contingent measures could involve maneuvers and deorbit of satellites, the latter often leading to limited or no capabilities from them. A host of strategies are evolving for SSA in a contested space environment. SSA encompasses a range of sensing, simulation and dynamics activities including modeling of the interaction between space-objects and their environments. Space surveillance, both from the ground and space, forms an integral component of present day space capabilities and needs to be harnessed judiciously for strategic as well as socially-relevant application areas. University of Calcutta has a long tradition of research on space science dating back to 1940s and a host of instruments are presently operational round-the-clock at the Institute of Radio Physics and Electronics (IRPE), University of Calcutta and Ionosphere Field Station (IFS) of the University located about 50km north-east of Kolkata in an area of relatively less radio-frequency interference. Operations of satellite-based systems and services are sometimes seriously challenged by events in the near-Earth space environment which severely compromises the performance of these systems. These effects are commonly referred to as Space Weather events and are relevant to different strata of the modern society. Impacts are particularly debilitating on life-critical applications on-board high dynamic platforms like an aircraft. The present talk will provide a brief overview of the adverse effects of some Space Weather effects from different latitudinal zones and attempt to provide mitigation through ionospheric reconstruction, modeling and applications of spatial and frequency diversity principles in a multi-frequency multi-constellation scenario.

INVITED TALK

Anomalously Large Lithium in red giant stars: A thorny problem to stellar evolutionary models

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ABSTRACT

As stars evolve from main sequence to red giant branch, the light element Li is expected to be depleted severely as a result of deep convection. In general, observations show Li abundance in RGB stars by a factor of 100- 1000 less than their natal clouds, and by a factor of 10-100 less than the maximum expected value by standard stellar nucleosynthesis models. Contrary to this general observational trends and theoretical models a few RGB stars show Li abundances exceeding present ISM value of A(Li) = 3.2dex. This has been a puzzle for over three decades. Solution to this problem has larger implications of Li evolution in the Galaxy. In this talk, we will describe the problem and the current efforts to understand its origin.

INVITED TALK

Magnetic Universe

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ABSTRACT

I will review how the presence of (strong) magnetic field influences and might dictate various astrophysical sources. It could be accretion disks and associated outflows/jets, white dwarfs, supernovae and other sources we observe. I will also attempt to touch upon how weak and strong fields work in somewhat complimentary fashion.

INVITED TALK

IR and VUV Spectroscopy of Astrochemical Ices

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ABSTRACT

InfraRed (IR) and Vacuum UltraViolet (VUV) spectroscopy are the two spectroscopy techniques that are used extensively to probe the astrochemical ices. IR spectroscopy is quite sensitive to the morphology changes the ices undergo while ices are subjected to temperature variations. Also, IR spectroscopy is used to confirm the synthesis of newer molecules that are brought by the energetic processing of ices. In the case of VUV, the spectra are used to find new molecules by comparing space based data from *Cassini* and *New Horizons*. In this talk I will discuss one of the recent experiments where IR spectroscopy was used to monitor the morphology of the ethanethiol ice using the S-H stretching vibration, a characteristic vibration of thiol molecules. The deposited sample was able to switch between amorphous and crystalline phases repeatedly under temperature cycles between 10 K and 130 K with subsequent loss of molecules in every phase change. Such an effect is dependent upon the original thickness of the ice.

INVITED TALK

Multi-experiment and multi-station approach to ascertain electromagnetic precursors of earthquakes using ground and ionospheric data

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ABSTRACT

Attempts have been made to look for electromagnetic precursors of earthquakes from the analysis of ground and ionospheric data corresponding to some major earthquakes occurred in Indian subcontinent during the years 2011-2015. The ionospheric data include those taken from GPS-TEC measurements at Agra (Geograph. Lat., 27.2^{o}N, Long. 78^{o}E), Surat (Geograph. Lat., 25.15^{o}N, Long. 72.78^{o}E) and some IGS stations including Lucknow (Geograph. Lat., 26.9^{o}N, Long. 80.9^{o}E), and VLF amplitude measurements of subionospheric propagating fixed frequency transmitter signals NWC (f = 19.8 kHz) and NPM (f = 21.4 kHz) at Agra station. The ground data include those from vertical electric field (f = 3 kHz) measurements using a borehole antenna at Mathura (Geograph. Lat., 27.49^{o}N, Long. 77.69^{o}E) about 70 Km north of Agra station. The earthquakes of large magnitudes (M $\geq$ 6.8) occurring in the regions surrounding India such as Pakistan and Pakistan-Iran border, Nepal, and northern Sumatra are considered. The well-established quartile based statistical analysis technique has been employed for the analysis of GPS-TEC data, whereas nighttime fluctuations and termination time techniques have been applied for the analysis of VLF amplitude data. The major results show that anomalous enhancements in diurnal variation of TEC occur 1 to 15 days before the main shocks at all the stations including IGS and GIM data with small variations with magnitude of the earthquake, depth and month of occurrence. This period also coincides with the precursory periods as deduced from nighttime fluctuations analysis of amplitudes of NWC and NPM signals monitored at Agra and borehole data at Mathura stations. Atmospheric gravity waves (AGW) are found to be responsible for perturbations in the lower and upper ionosphere a detailed study of which is made along with VLF (NF) data analysis. These results are not influenced by lightning and magnetic storms.

INVITED TALK

Four Very Low Mass Stars and an Exo-Planet - Journey of PARAS

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ABSTRACT

In this talk, we describe the Stabilized High-Resolution Fibre-fed Echelle Spectrograph covering the entire visible region (called PARAS) built for exploring the Exoplanets using the 1.2m telescope at Mt Abu. The instrument is also being used for detecting Very Low Mass Stars (VLMS) in Eclipsing Binary (F+M) systems in order to address the discrepancy between the observed and theoretical radii of the VLMS. Some of the latest results from the VLMS survey will be presented. The first planet discovery from PARAS - a Sub-Saturn in a nearby Sun-like Star will be high-lighted. Some of the future plans at Mt Abu will also be mentioned.

INVITED TALK

New results on the space weather footprints over low latitudes

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ABSTRACT

Electric field plays a very important role in the distribution of ionospheric plasma and generating plasma instabilities over low latitude that have implications for communication and navigational applications. In recent times, a new technique has been evolved to capture the space weather induced electric field fluctuations over low latitude ionosphere by capturing the OI 630.0 nm airglow emission through narrow spectral band and narrow field-of-view (FOV) intensity measurements. This technique has yielded several new results by efficiently capturing the footprints of the impact of space weather over low latitude ionosphere-thermosphere system. As a result, this measurement philosophy is now being adopted to design payloads for a future Aeronomy satellite and Venus mission. Further, a number of results have been obtained that throw new light on the effects of relatively less-studied drivers like IMF By, solar wind density, substorm and disturbance dynamo on the low latitude ionospheric electrodynamics. In addition to these results, new results on the geo-effectiveness of co-rotation interaction region and interplanetary corornal mass ejection are also obtained. These results bring out new directions to understand the coupling between solar wind, and the magnetosphere-ionosphere system of the earth. A few of these results will be presented.

INVITED TALK

Role of GPS based total electron content measurements in earthquake prediction studies

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ABSTRACT

Among the various types of natural hazards, Earthquake is the one for which no full proof prediction technique has been developed till today with the result there occur huge losses of lives and destruction of properties almost every year in one part of the earth or other. In India itself, there occurred more than 10 devastating earthquakes in the last 60 years in which thousands of people have died and properties worth thousands of crores of rupees damaged. Since earthquakes give severe jolt to the economic condition of a country, research work has been given top priority for prediction and forecasting of such natural catastrophe all over the globe. In India, various seismological techniques have been tried in the recent past but no success has been achieved. Recently, a new technique known as 'Seismo-electromagnetic technique' which is based on ground and ionospheric based monitoring of electromagnetic signals and anomalies generated due to earthquakes has been attempted which has produced some convincing results giving a ray of hope of possible short term earthquake prediction in near future. In the recent era, GPS based total electron content measurements have been studied extensively due their availability around the globe and their accuracy of results. While seismo-electromagnetic technique employs direct monitoring of ULF/VLF electromagnetic emissions from earthquake sources and their effect on VHF propagation on the ground, the ionospheric perturbation caused by earthquakes has drawn greater attention of the scientific community in recent years vis-a-vis prediction of earthquakes. The availability of Global Positioning Satellite (GPS) and its application in monitoring of Total Electron Content (TEC) of the ionosphere, which undergoes significant variation in relation to earthquakes, has made this study more simple and easy to handle. In this talk, some excellent results of GPS based total electron content in relation to earthquakes have been presented and the Lithosphere-Atmosphere-Ionosphere coupling mechanisms have also been discussed briefly. This talk is very useful for the students as well as to the researchers who are working in this area and it also motivates to the young researchers to pursue their higher studies in this field.

INVITED TALK

Supernova and their remnants in the era of Astrosat

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ABSTRACT

The AstroSat instrument with its multi-wavelength (0.2-150 keV, plus 1300-3000 Ang) capability has provided us with a unique opportunity to carry out deep, simultaneous study of both young supernovae, as well the remnants themselves, both in low resolution (~ few arcmin), soft x-ray (0.2-8 keV) bands as well as in high resolution (~1.2 arcs) NUV and FUV narrow band filters. Deep UV maps of segments of Vela and Cygnus SNRs, observed in the narrow band NUV (100 A at 2800 A) and narrow and broad band FUV filters, show distinct regions of hot (104−5 K) and intermediate (5000- 8000 K) temperatures via emission lines of C IV (1550 Ang.), He II (1640 Ang.), and Mg II lines (2800 A). Using low resolution Astrosat/SXT soft x-ray maps, and archival optical observations of select fields, a relation between x-ray bright (106−7) K and cool, optical regions is established, thus providing a more complete picture of the interaction of blast wave and supernova ejecta with the local medium.

INVITED TALK

A plausible way to infer the accretion disk magnetic fields of LMXB dippers using Fe XXV and Fe XXVI lines

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ABSTRACT

Low-mass X-ray binaries (LMXBs) show a wide range of X-ray properties which can reveal many physical conditions of the associated accretion disks. Several LMXBs often show periodic intensity dips in X-ray, and spectral change in iron Kα fluorescence lines, Fe XXV (6.68kV) and Fe XXVI (6.97 kV), during the dips. We use the spectral synthesis code CLOUDY to understand the spectral changes in LMXB dippers. Our models show that changes in ionization parameter and ionized column density can explain the spectral change during dips. We also find that the presence of magnetic field changes the features of iron Kα spectral lines. We perform a detailed modeling of LMXBs 4U 1323-62 and 4U 1916-053, and report the underlying physical conditions such as density, radiation field, metallicity, wind velocity, magnetic field etc. We estimate the upper limit of the existing magnetic field in the associated accretion disks is few 100 G. We suggest that magnetic field prevailing in the accretion disk could be derived accurately with the help of detailed modeling of iron Kα lines, which will improve with more high spectral resolution observations in future.

INVITED TALK

Unsolved mysteries of the sun and the solar system: Clues from exoplanetary data

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ABSTRACT

The sun, closest star and protector of life on the Earth, needs to be studied carefully. Some of important shrouded mysteries such as magnitude of angular velocity of the core, genesis of 22 yr magnetic cycle, nature of sun's near surface rotation profile and the low surface angular momentum are yet to be deciphered. Physics of high angular momentum and architectural distribution of terrestrial and giant planets of the solar system are need to be probed further. With high precision instruments and innovative data analysis techniques, recent detection of many number of planets around other stars has revolutionized the understanding of genesis and architecture of the solar system. By using exoplanetary data, possible clues for solutions of the afore mentioned mysteries of the sun and solar system will be presented in the talk.

INVITED TALK

Relativstic flows around Compact Object

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ABSTRACT

Most of the matter accreting onto a compact object, or emanating from its vicinity, can be satisfactorily modeled as a fluid. These fluids are different from terrestrial versions. The temperature can range from relativistic values to non-relativistic one and at high temperatures the constituent particles are charges and not neutral particles as is the case in the terrestrial version.

We use relativistic equation of state to describe trans-relativistic fluid, around compact objects and at regions far from it. For steady state investigation we took the help generalized Bernoulli parameter which acts as a constant of motion and the fact the global solution should be of higher entropy. This approach is considered for dissipative flow in curved geometry around black holes, magnetosphere around neutron stars or white dwarfs and also for magnetically driven outflows. We show that the flow geometry close to a black hole is quite different from a neutron star because of the strong magnetic field around the latter, which has implication on the radiative processes dominant nearby. We also obtained shock solutions for lepton dominated accretion flow around neutron stars, but not around black holes, this is again due to the different flow geometry around the two different type of compact object. Magnetically driven flow in the special relativistic domain, is able to produce flows which connect both the Alfven and fast sonic points. Numerical simulation of fluid with relativistic equation of state, show distinct differences depending on the composition of the flow.

INVITED TALK

Protoplanteray disk evolution in massive star forming environments

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ABSTRACT

O and B type stars have important feedback influence on the evolution of protoplanetary disks orbiting around nearby young stellar objects and likely on the process of planet formation occurring in them. The massive star forming regions with statistically rich number of young stellar objects are outstanding laboratories to study this feedback process. Using unbiased, complete sample of disk and diskless population, we analyze the spatial variation of the disk fraction in a smaple of high masss star forming regions in the Milky Way.
We study the correlation of disk fraction with the local values of Far and Extreme ultraviolet radiation fields and the local stellar surface density. Whether or not the massive associations are potentially hostile to protoplanetary disks and the disks can safely evolve in to planetray systems in such environments will be discussed in this talk.

INVITED TALK

Multiwave studies of AGN with AstroSat

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ABSTRACT

AstroSat has had several long look observations of many AGN, both Seyferts and Blazars, thus providing variability studies in a wide band from UV to hard x-rays at a number of time scales. It has also provided excellent UV images of the Seyfert galaxies showing a wide variety of phenomenon. I will present results from such observations carried out by me and my collaborators.

INVITED TALK

Extended H2 emission line sources from UWISH2: Survey Overview, Data Releases, and Recent Results

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ABSTRACT

Jets and outflows from Young Stellar Objects (YSOs) are one of the early signposts of stellar birth. Emission in the H2 1-0S(1) line at 2.12 micron is a powerful tracer of shock excitation in these objects. In order to study these objects, the UK Widefield Infrared Survey for H2 (UWISH2) has conducted an unbiased survey along the Galactic Plane in the 1-0S(1) emission line using the UK Infrared Telescope. The images have a five sigma detection limit of point sources of K~18 mag and the surface brightness limit is 10^{-19} W m^{-2} $arcsec^{-2}$. The survey has revealed jets and outflows from both low- and high-mass young stellar objects. In addition, it has also revealed shock excited features around the evolved stars and supernova remnants. In this talk, on behalf of UWISH2 team, I shall briefly outline the survey, the publicly available data products, and the various results obtained, with an emphasis to the large and unbiased sample of outflows identified in the nearby star-forming regions, in particular, I will highlight the results obtained in the Cygnus-X and M17 cloud complexes. The typical properties of outflows will be presented and their importance in understanding the early phases of stellar evolution will be discussed.

INVITED TALK

Radio wave and satellite signal propagation medium in D and E layers of the ionosphere: resonance and optical properties

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ABSTRACT

The nature of sporadic interruptions of the global positioning systems is the reason for intense permanent studies on the influence of the Sun activity on the Earth atmosphere. The detailed analysis of the experiments performed at the Cornel University and some other research centers done at the Semenov Institute of Chemical Physics revealed the direct correlation of the intensity of the flux of incoherent UHF irradiation from D and E layers in the radio frequency wave range with the positioning precision. This irradiation comes from the transitions between the Rydberg states excited in the two-temperature recombination plasma and splitted by the interactions with neutral medium molecules. Because the necessary experiments demand enormous financial expenditures, the theoretical studies of the dynamics of the process and the intensity and shape of the irradiated waves become of primary importance. The data thus obtained serve as the experimental basis for the general kinetic scheme that establishes the time dependence of the concentration of Rydberg particles vs density, flux and the temperature of the ionosphere electrons. The results of consideration serve as a basis for the radio-chemical physics of the Earth atmosphere as a branch of science on the interaction of the electromagnetic waves with the resonance quantum medium containing the Rydberg molecular complexes that populate the upper atmospheric layers at the altitude 80-110km). These complexes are definitely responsible for the signal delay from the satellite groups. The radiation transitions between the splitted electronic states are responsible for additional background irradiation in UHF and IR wave ranges. It is of primary importance for the fundamental studies and applies in numerous scientific and technical applications. The results of our investigations permit to determine simultaneously the plasma parameters and the characteristic delays of the signal at different frequencies and similar physical conditions. These data are necessary for efficient applications of the positioning systems.

This work was supported by Russian Foundation for Basic Researches (grant №16-05-00052).

INVITED TALK

Adsorption energies of atoms and molecules on the amorphous ice surface based on quantum chemistry calculations

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ABSTRACT

We propose a new computational model to estimate adsorption energies of atoms and molecules on the amorphous ice surface in the inter-stellar space environment. Our model can incorporate large time-scale fluctuation at the low-temperature with relatively small computational cost, and therefore, quantum chemistry calculations are available. We systematically estimated the adsorption energies of C, N, and O atoms based on the density functional theory (one of quantum chemistry calculations). The adsorption energies of N and O were computed to be 400 and 1440 K, respectively, which are well consistent with the experimentally reported values. The adsorption energy of C was computed to be 14100 K. Consequently, we found that the binding of N atom is purely physisorption, while that of C atom is chemisorption in which a chemical bond to an O atom of a water molecule is formed. We also investigated effects of newly estimated adsorption energies onto simulated chemical compositions based on rate-equation method.

INVITED TALK

Highlights of the INTEGRAL results

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ABSTRACT

Selected scientific highlights will be presented from the first 16 years of observations of the gamma-ray sky by ESA's INTEGRAL space telescope. Its unprecedented angular resolution and sensitivity at high energies (20 keV) has allowed INTEGRAL to detect around 2000 objects, many of which are new. Sources that have been classified are predominantly represented by active galactic nuclei (AGN) and X-ray binaries (XRBs). Together with unclassified sources, they account for nearly all of the diffuse Galactic background emission. Furthermore, INTEGRAL has created an all-sky map of the 511 keV distribution helping to identify potential dark matter sites. The distribution of Al-26 follows massive star-forming regions and reflects the rotation of the Galaxy. Gamma-ray bursts (GRBs) are detected in the wide field of view (FOV) at a rate of 1 per month, but INTEGRAL's design also enables it to detect GRBs outside its FOV. Previously rare, XRBs with supergiant companions are an emerging class. This underscores INTEGRAL's ability to peer through the dust that enshrouds these sources and which made them invisible to previous X-ray surveys. In the last few years, The INTEGRAL telescopes have also enable us to measure the polarisation of bright gamma-ray sources such as the Crab nebula and pulsar, Cygnus X-1 and GRBs. Last but not least, thanks to its high orbit and a set of complementary detectors providing continuous coverage of the whole sky, the INTEGRAL satellite has unique capabilities for the identification and study of the electromagnetic radiation associated to gravitational waves signals and, more generally, for multi-messenger astrophysics.

INVITED TALK

Probing the GRB prompt emission mechanism, magnetic field geometry, and jet structure with linear polarization

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ABSTRACT

The prompt emission mechanism in gamma-ray bursts (GRBs) remains unclear after decades of work. The non-thermal band-like spectrum has been shown to be explained by a few emission models, including synchrotron emission, inverse-Compton scattering of quasi-thermal radiation released at the photosphere, and Compton drag. Measurements of linear polarization can break the degeneracy between these models and also provide key insights into the structure of relativistic outflows in GRBs. To date, high levels of prompt emission linear polarization above 50% with a 3-sigma detection significance have been measured by various instruments. This talk will briefly review the predictions of linear polarization from the different emission mechanisms and for different jet angular structures. I will argue that a single robust measurement of linear polarization above 50% would strongly point towards the outflow having a large scale or globally ordered magnetic field and synchrotron emission as the underlying mechanism. On the basis of Monte Carlo simulations, I will further argue that such an emission mechanism will also be favored if most GRBs are linearly polarized at levels higher than 20%. Future polarization measurements of relatively nearby, like GRB 170817A, or distant bright GRBs observed on-axis will be able to finally crack this enigma.

INVITED TALK

Kinematics and Dynamics of two Solar Extreme Ultraviolet (EUV) waves

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ABSTRACT

We present here, the observations of two successive fast extreme ultraviolet (EUV) wave events observed on 2016 July 23 observed by the Atmospheric Imaging Assembly (AIA) instrument on board the Solar Dynamics Observatory (SDO) satellite, with a traveling speed of ≈675 and 640 km s^{-1}, respectively. These two wave events were associated with two filament eruptions, two medium class solar flares, and two Coronal Mass Ejections (CMEs) from the NOAA active region 12565, which was located near the western limb. We observed the interaction of the EUV waves with a coronal helmet streamer located in the south direction . When these waves propagates into the helmet streamer, a slowly propagating wave with a traveling speed of ≈150 km s^{-1} is observed along the streamer. We suggest that the slowly-moving waves are slow-mode waves, and interpret this phenomenon as the magnetohydrodynamic (MHD) wave mode conversion from the fast mode to the slow mode.

INVITED TALK

Space Exploration Using Light-weight Payloads Onboard Meteorological Balloons

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ABSTRACT

An alternative approach of doing space experiments to study the Universe through radiation detection is being practiced by Indian Centre for Space Physics through almost a decade. This methodology exploits futuristic techniques using miniaturized equipment and light-weight radiation detectors to reduce required budget, manpower and realization time of the experiments. Small meteorological balloons are deployed to carry the payloads into the near space (~ 40 km). We have been able to obtain a great deal of atmospheric and space data during the 109 time visits of the near space so far. The data has been used to study many important phenomena like altitude dependence and solar modulation of cosmic rays, X-ray radiation from sun, pulsar etc. along with meteorological data such as pressure, temperature, wind velocity profiles etc. up to a very high altitude. A brief overview of the experimental techniques, payload construction and function will be presented here along with the important results obtained in this venture.

INVITED TALK

Accretion Dynamics of Outbursting X-ray Sources

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ABSTRACT

Outbursts in compact X-ray binary systems may trigger due to change in mass transfer rate at the outer edge or a sudden surge of viscosity initiates the inward movement of the disc. We discuss both the scenarios in context of X-ray outbursting sources with shorter as well as longer rising time of outburst. We study the accretion dynamics through the evolution of accretion disc parameters and observe that accretion rates evolution depends on the rising time of the outburst. Finally, we apply this formalism on few X-ray binary systems.

INVITED TALK

Turning points in Accretion/Outflow problem over last Eighty Years

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ABSTRACT

Accretion and Outflow problem started about eighty years ago after the Hoyle and Lyttlelon (1939) paper was written. Since then the subject progressed at a steady pace, primarily driven by observational results. I discuss the contributions of Bondi, Bisnovatyi-Kogan, Shakura & Sunyaev, Paczynski, Abramowicz and others. Finally, we discuss the contribution of our group where the theory preceded observations! I show that we can understand most of the observational aspects, such as the spectral and timing properties, using the two component advective component flows.

INVITED TALK

On the nature of the transonic accretion flows around black holes

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ABSTRACT

In this presentation, I shall discuss on the topic of transonic accretion flows around black holes. The emphasis will be given on to the development of the subject over the last 50 years and the remaining key issues related to that will be highlighted.

INVITED TALK

Astrophysical mid to far infrared features and Polycyclic Aromatic Hydrocarbons

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ABSTRACT

The ubiquitous presence of polycyclic aromatic hydrocarbon (PAH) molecules in space is interpreted due to observations of emission features in the mid-infrared spectral window along a wide variety of astrophysical objects. Yet, among the growing number of molecules in the interstellar medium (ISM) aromatic molecules are rare. PAHs are considered to form in the circumstellar shells of carbon rich planetary nebulae. Being highly stable they survive through harsh conditions and are also seen in star forming regions. Both top-down and bottom-up approach of PAH formation are envisaged. Theoretical studies demonstrate that the variations in the infrared emission features is related to the object type and hence to the type of PAHs possible in that medium. The recent discovery of benzonitrile in TMC-1 through its rotational transitions is a vindication of the bottom-up formation scenario. Comparing observations with combined spectra of groups of PAHs give useful information of the physical and chemical environments in the astrophysical object. Formation of emission models using infrared data of PAHs of different size, ionization state, PAH derivatives etc. will be reviewed. In view of upcoming facilities and space probes, like James Webb telescope, observing in the far infrared, possible role of PAHs in this window will also be discussed.

INVITED TALK

Rotational evolution of young stellar objects in star-forming regions

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ABSTRACT

Pre-main sequence (PMS) stars first came into the spotlight due to their photometric variable characteristics. Observational studies have been performed on exploring variability in young stars and the role of angular momentum in their stellar evolution. The variability in a PMS star is thought to be originated via various mechanisms e.g., magnetically induced cool starspots or magnetically channeled variable accretion flows generating hot spots on the star surface, eclipsing binary, opacity due to non-uniform dust distribution, etc. In this presentation, we like to highlight some of our results on the variability of young stellar objects in few galactic star-forming regions.

INVITED TALK

A robust computer model to investigate extra-terrestrial modulations of Earth's atmosphere

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ABSTRACT

Ionization of Earth's atmosphere by UV and X-ray radiation from extra-terrestrial sources is the driver of many significant evolution distributed over a large range of timescales. Part of the atmosphere, called ionosphere, owes its existence to the ionization of neutral molecules by solar UV. Solar flares which are prominent mostly in EUV and soft X-rays modulate the lower part of the ionosphere for few minutes up to few hours. Currently plenty of signatures of hard X-ray and gamma ray effects on the middle and upper atmosphere due to celestial sources like, Gamma ray bursts (GRB), Soft gamma repeaters (SGR) etc. has been observed. During such events, impulsive ionization of neutrals and gradual decay due to atmospheric recombination processes and resulting modulations in electron/ion densities manifest in the modulation of Very Low Frequency(VLF) radio wave signals, propagating between a pair of transmitter and receiver. Interpretation of these modulations is challenging due to the involvement of multiple space and ground propagation parameters in the modulation process and requires in-situ modeling of the plasma modulation and it?s dependence on the propagation characteristics. Here we present results of our effort on reconstructing the observed modulation of VLF amplitude during such events using a robust model consisting of Monte Carlo ionization simulation, ionospheric chemistry and an advanced radio-propagation code. New theoretical developments of related observation characteristics such as, the peak-time delay, dependence on the flare time and spectrum characteristics etc. are presented. For redundancy and validation of our code we also model the modification in Cosmic Noise Absorption (CNA) during flares. We examine the possibility of extracting the source characteristics, such as, X-ray spectrum and timing profile of flares with inverse reconstruction from VLF data. To investigating the sensitivity of the ionosphere and VLF propagation characteristics to such radiations we deploy a computationally simulated delta function in time, or a spike, associated with various source and propagation characteristics and find their ion-chemical interactions in the atmosphere and influence on VLF signal. It is found that the any complex modulation of atmospheric plasma characteristics and VLF due to celestial UV and X-ray sources can be considered to be produced by series of consecutive delta function sources of varying characteristics.

INVITED TALK

Numerical modeling of long-path propagation characteristics of radio waves as observed from Indian Antarctic stations

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ABSTRACT

Long path VLF radio wave propagation has a distinctive feature that during its propagation it experiences large variations of solar irradiation and degree of ionization. The propagating waveguide modes and modal conversion is completely different that for shorter path (~<3000 km). Study of radio signal propagation characteristics in Antarctica during summer period gives a unique opportunity to justify this phenomena. During summer, the VLF signal modulation is governed by the whole day presence of D-layer due to 24 hours solar radiation in at least some sections of the propagation path. We present propagation characteristics of VLF signals transmitted from VTX (18.2 kHz) and NWC (19.8 kHz) from India and Australia respectively recorded simultaneously at Indian permanent stations Maitri (Lat. 70°45′S, Long. 11°40′E) and Bharati (Lat. 69°24′S, Long. 76°10′E) in Antarctica. Stable diurnal variation of the signal (both amplitude and phase) has been obtained with no signature of nighttime fluctuation. We reproduce the spatial signal amplitude variation by using advanced GPI ion chemistry model by calculating the ionization rate and compute D-layer electron density profile over the entire path. Using solar zenith angle profile and the Wait's two component model we reproduce the temporal signal amplitude variation for all possible VLF baselines. We present the attenuation rate of the dominant waveguide modes and the effects of Antarctic polar ice on the signal attenuation. We observed strong attenuation in signal amplitude during propagating over Antarctic ice mass and we corroborate this by numerical simulation.

INVITED TALK

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ABSTRACT

I will discuss the recent LIGO-Virgo observations of GW170817 and the interesting constraints they put on the neutron star equation of state. I will also discuss how these constraints might evolve with future possible gravitational wave observations of binary systems involving neutron stars and how they might be combined with inputs from electromagnetic signals from neutron star systems. Implications on constraining the Hubble parameter with such obsevations, as well as those of binary black holes, will also be presented.

INVITED TALK

Fast variability in black-hole binaries: accretion and General Relativity

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ABSTRACT

I will review the current standpoint of fast variability from black-hole binary systems. The large amount of data obtained in the past two decades has led to a significant advancement in our knowledge, although it still needs to be consolidated through new observations. I will present the more recent evidences of General Relativistic effects obtained from RossiXTE data and will present new data from the Astrosat mission.

CONTRIBUTORY TALKS

CONTRIBUTORY TALK

Orientations of the elliptical galaxies

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ABSTRACT

Determination of the orientation of the elliptical galaxies is an important problem. We determine the orientations of the light distribution of individual elliptical galaxies by combining the profiles of photometric data from the literature with triaxial models. The orientation is given by a Bayesian probability distribution. The likelihood of obtaining the data from a model is a function of the parameters describing the intrinsic shape and the orientation. Integrating the likelihood over the shape parameters, we obtain the estimates of the orientation. We find that the position angle difference between the two suitable chosen points from the profiles of the photometric data plays a key role in constraining the orientation of the galaxy. We apply the methodology to determine the orientation of NGC 7619 galaxy.

CONTRIBUTORY TALK

Hα imaging of Wolf-Rayet Galaxies

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ABSTRACT

The morphological study of stellar light and ionized gas in blue compact dwarf star-forming galaxies may provide insight to the mechanisms responsible for fuelling and triggering recent/ongoing star formation. With this aim, we present the Halpha and Hbeta observations of blue compact dwarf star-forming galaxies taken with 3.6-m Devasthal Optical Telescope (3.6-m DOT). Both the Halpha and Hbeta images of galaxies show the clumpy and disturbed morphologies of the ionized gas and stellar light distributions, indicative of recent tidal interaction or merger scenario which is most likely responsible for availing the galaxies of their cold gas and triggering recent star formation. Using these observations, we also present the dust distribution across the extent of galaxies using Halpha and Hbeta flux ratio. The Halpha/Hbeta ratio varies considerably with position throughout the galaxies. Under the assumption that dust traces the presence of molecular gas, our results suggest that the molecular component of the galaxies, which is required for fuelling active star formation, is also clumpy.

CONTRIBUTORY TALK

Multi-wavelength studies of blazars

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ABSTRACT

To provide a detailed understanding of blazar and its environment, we study variability over diverse timescales using various statistical methods. As optical flux variations in blazars are often followed by spectral changes, thus we examine their colour - magnitude relationship on diverse timescales which helps us to understand the origin of variability. Presence or absence of correlation among multiple frequencies, variability timescales or a quasi-periodic oscillation can be used to constraint the size of the emitting region and also derive black hole mass. For this, we have developed a suite of time series analysis techniques namely, Structure Function, Discrete Correlation Function, Lomb-Scargle periodogram, Wavelet analysis and Power Spectral Density which we apply to analyze blazar light curves. Further, to study the core-jet morphology of blazars, we develop a piecewise Gaussian fit analysis technique. Using this, we are able to find spectral indices, time lags, core position offset, core radius, mean magnetic field strength, and other jet parameters. In essence, we explore complex phenomena governing blazars through the analysis of observational data and its applications using various theoretical models which further helps us to understand the physics of the inner regions of blazars.

CONTRIBUTORY TALK

Detecting short GRBs with AstroSat Cadmium Zinc Telluride Imager with improved noise removal

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ABSTRACT

Detection of a short GRB170817A along side GW170817 from a neutron star merger has prompted the search for similar short GRBs. Characterizing these short GRBs will not only give insight into the science of NS-NS mergers, but also the rate of occurrence of such events. GRB170817A originating from a very low redshift with comparatively lesser fluence indicates that the Jet is being viewed off axis, which was confirmed by VLBI measurements of the inclination. This prompts us to look for farther fainter events to populate the fainter side of the Log N-log F plot. Sensitive All sky monitors like CZTI can be used to explore this population. However, searching for fainter events is difficult as they exist in shorter time scales where the detector noise is dominant. Characterising and excluding the noise events is crucial in the search for short GRBs. Cadmium Zinc Telluride Imager onboard Astrosat, being comparatively less prone to charge particle background due to its low inclination orbit, with pixelated detectors, and an open detector above 100 keV, can a be short GRB detector if the noise sources are eliminated. Here we develop an algorithm to detect and eliminate various sources of noise in Astrosat CZTI. The pixelated CZT detectors of this instrument, are triggered by individual photons, and each such 'event' is separately recorded. However, the detectors are also prone to 'noise' events: photons from other sources, cosmic rays and thermal instabilities being amongst them. Here we examine the statistical nature of all CZT events, in time, energy and distribution in detector plane to segregate genuine X-ray events from noise. It is found that heavy cosmic ray interactions can trigger noise events until 200 ms after their interaction. The proposed algorithm eliminates all noise events and hence improves the sensitivity of the instrument to detection of transients like Gamma Ray Bursts, in addition to producing cleaned data of the observed astrophysical sources. A case study of 64 Fermi GBM-detected short GRBs shows that the number of detections increased from 11 in the usual CZTI pipelines to 21 in noise-cleaned files.

CONTRIBUTORY TALK

Implications of observed short-timescale gamma-ray variabilities on blazars jets

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ABSTRACT

The locations of emission of gamma-ray radiation in active galactic nuclei jet are highly debated and it range from light-hours to a few light-year in quasar jets. The situation is more complex in the case of flat spectrum radio quasars, where the gamma-rays photons above 10 GeV may interact with the UV radiation from broad line region and get absorbed. I will be talking about the recent detections of high energy photons during the minute-scale variability at gamma-ray energies from flat spectrum radio quasars. The minute-scale variability and detection of high energy photons from blazar jets challenges the standard shock-in-jet scenario where gamma-ray emission of blazars is commonly assumed to be associated with shocks traveling down the jet or with the jet formation region. The observed fast variability could either indicate the dissipation of magnetic islands or protons in a collimated beam from the base of the jet encountering the turbulent plasma at the end of the magnetic nozzle.

CONTRIBUTORY TALK

Distances and Peculiar Velocities for Galactic Black Hole Transients with Gaia DR2

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ABSTRACT

Gaia is playing a very crucial role by providing the most accurate parallax and proper motion for more than 1.3 billion sources. Trigonometric parallaxes provide the most reliable distance estimates and we have used parallax from Gaia DR2 to estimate distance to the confirmed black hole binaries and potential candidates for hosting black holes. Distance estimates to 11 black hole binaries are obtained including the new transient MAXI J1820+070, which is found to lie at a distance of ~ 3 kpc. The potential surprise is BW Cir, which DR2 places at distance of about 1 kpc, possibly making it the nearest dynamically confirmed black hole. We have made use of proper motion from Gaia DR2 to study the kinematics of black hole binaries and peculiar velocities of 10 black hole binaries is calculated. If the association of Gaia counterpart to the source is correct, BW Cir is most likely a new high peculiar-velocity black hole binary in our Galaxy. The data is further utilized to trace the origin of Cyg X-1 and its association with Cyg OB3. It is verified that the two systems have similar distances, proper motion and peculiar velocities, and it is further observed that the distance between the two remained less than 300 pc over the past 8 Myr i.e. since the birth of Cyg X-1. Considering the typical size of stellar associations in our Galaxy, Cyg X-1 most likely seems to be originated in Cyg OB3.

CONTRIBUTORY TALK

Asymmetries in the nebular phase emission of Type IIb supernovae

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ABSTRACT

Type IIb supernovae (SNe) are the unique members of stripped envelope group where the spectral features transition from that of Type II to Type Ib SNe. Type IIb SNe show high asymmetry in their nebular line profiles due to either a highly clumped ejecta configuration or due to a dusty environment. As an example, we study in detail the asymmetric isolated and unblended line profiles of Mg I] 4571 Å, [O I] 6300, 6364 Å and [Ca II] 7291, 7324 Å lines in a Type IIb SN 2015as. The [O I] evolution shows a double peaked structure with a systematic blueshift mostly caused by low mode convective instabilities or suppression of the redshifted part of the spectrum due to dust formation. Geometric explanantion supports oxygen blob moving perpendicular to the line of sight. Mg I] evolution also shows an asymmetric structure indicating similar origin of [O I] and Mg I] in the SN ejecta. Less asymmetric [Ca II] lines mostly indicates the uniformly distributed pre-existing material. Estimation of [O I] mass from the nebular lines indicate 0.44 Msun of oxygen is ejected during explosion. The intensity ratio of the [Ca II]/[O I] nebular lines favours either a main sequence progenitor mass of 15 Msun or a Wolf Rayet star of 20 Msun.

CONTRIBUTORY TALK

Dynamic images of Two Component Advective Flow around black holes in presence of outflows and cooling

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ABSTRACT

We present images, spectra and energy dependent time lags of Two Component Advective Flow. Hydrodynamical configuration of accretion disk is generated by Total Variation Diminishing (TVD) method. To produce the spectra, we incorporate Comptonization via Monte-Carlo technique. The spectral energy distribution, images over various inclination angles on observer plane are obtained by Ray-Tracing process. Variations caused by the self consistent outflows are reported. Also, the effect of cooling on the images and spectra are demonstrated.

CONTRIBUTORY TALK

Probing the optical and X-ray properties of three eclipsing polars

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ABSTRACT

We present optical (photometric and spectroscopic) and X-ray analyses of three candidate polars namely RX J0859.1+0537, RX J0749.1-0549, and RX J0649-0737. Optical photometric and X-ray observations of these three candidates reveal eclipse features that are deep, total, and variable in shape and are classified first time as eclipsing polars. Both the optical and X-ray modulations of RX J0859.1+0537, RX J0749.1-0549, and RX J0649.8-0737 are found to occur at the derived orbital periods of 2.390?0.003 hrs, 3.67?0.001 hrs, and 4.340?0.001 hr, respectively. Among these systems, RX J0859.1+0537 is found to be 12th eclipsing polar, which lies in the period gap, while RX J0749.1-0549 and RX J0649.8-0737 are found to be 6th and 7th long period eclipsing polars. The eclipse width at half depth was observed to be more than $\sim$ 0.2 for each system, indicating that these are highly inclined binary systems. The optical spectra of these systems are typical of polars with strong high ionization emission lines and inverted Balmer decrement which further confirms the magnetic nature of these systems.

CONTRIBUTORY TALK

X-Ray Observations of Very Faint X-Ray Transients (VFXTS) Versus Bright X-Ray Transients

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ABSTRACT

Low mass X-ray binaries (LMXBs) contain a black hole or neutron star that accretes matter from a companion star which typically has a mass lower than that of the accretor. Most low mass X-ray binaries are transients which means they undergo outbursts sporadically. During an outburst, the X-ray luminosity can increase up to a few times 10^{37}-10^{39} ergs/s (bright outbursts). These outbursts are thought to be triggered by the thermal-viscous instability in a thin accretion disk. In the last 15 years, it has been found that there are LMXBs which show sub-luminous accretion outbursts, i.e., having peak outburst luminosities within a range of 10^{34}-10^{36} ergs/s. This class of LMXBs is known as very faint X-ray transients (VFXTs). These faint outbursts are believed to occur due to radiatively inefficient accretion. One of the challenging aspect in the study of these very faint X-ray transients is to understand the nature of a compact object. Here, in this talk I will discuss a detailed study of two VFXTs, namely; MAXI J1957+032 (J1957) and Swift J1357.2-0933 (J1357) followed by some results of the bright X-ray transients observed with AstroSat.

CONTRIBUTORY TALK

Optical study of peculiar nova ASASSN-18fv

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ABSTRACT

We present optical spectroscopic observations of nova ASASSN-18fv starting from 2018 March 24 to 2018 June 21. The optical spectra are taken from Australia and India. The spectra are dominated by hydrogen Balmer lines and Fe II and O I lines having P-Cygni profiles in the initial days, typical of an Fe II class nova. The measured FWHMs were in the range 1500-1800 km s−1 for the Hα and Hβ lines. The values narrowed to 800-1000 km s−1 by 50 days from the outburst due to possible interaction with the evolved secondary star. The spectra showed prominent He I lines along with H I and O I emission lines after 22 days from the outburst. The spectra showed a rapid development to higher ionization and the coronal lines are also seen in the early phase. All these features indicate that the nova can be of hybrid or Fe IIb class. There is no dust emission seen from the nova ejecta.

CONTRIBUTORY TALK

Optical Flux and Spectral Variability of the Tev Blazar Pg 1553+113

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ABSTRACT

We present the results of our optical (VRI) observations of the TeV blazar PG 1553+113 over eight nights in 2016 April. We monitored the blazar quasi-simultaneously in V and R bands each night and examined the light curves (LCs) for intraday flux and color variations using the latest power-enhanced F-test. The source was found to be significantly (> 99%) variable in both V and R bands only on April 13, while clear variations only in R band LCs were seen on April 8, 9 and 12. No temporal variation was seen in the color during the obervation period. Significant positive correlations between the V-R color index and V band magnitude were detected over six nights indicating the general bluer-when-brighter trend. We found a mean optical spectral index of $\sim 0.83 \pm 0.02$ with a maximum variation of 0.21 by fitting a power law ($F_\nu \propto \nu^{-\alpha}$) in the optical (VRI) spectral energy distribution of PG 1553+113. We briefly discuss the possible physical processes responsible for the observed flux and spectral variability.

CONTRIBUTORY TALK

Formation of Two-Component Advective Flows around Neutron Stars

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ABSTRACT

We use the Smoothed Particle Hydrodynamics method to simulate the behaviour of both inviscid and viscous matter accreting on a neutron star. The fundamental difference between accretion onto black holes and neutron stars is the presence of a hard surface for the latter. We show that for an advective flow with nominal viscosity and angular momentum, the solution allows two shocks in the flow. The outer one, forms due to a strong centrifugal barrier and is called CENtrifugal pressure dominated Boundary Layer or CENBOL, which is a common feature for both neutron stars and black holes. The inner shock or Normal Boundary Layer (NBOL) forms very close to the surface of a neutron star, due to the presence of the physical boundary. In presence of strong cooling (blackbody emission from the optically thick region), a disk is formed along the equatorial plane. The two-components, disk, and halo are disaggregated out of the halo component and remains steadily oscillating. Our results capture both the low and high-frequency quasi-periodic oscillations. We also compute the spectra and compare with a few observed cases. This indicates that the TCAF is the most general flow configuration for a neutron star when the magnetic field is weak.

CONTRIBUTORY TALK

Stratospheric Altitude Microbiology Probe for Life Existence (SAMPLE) and Mico-meteorite collector- A Method of Collection of Stratospheric Samples Using Balloon-Borne Payload System

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ABSTRACT

Earth's atmosphere at stratospheric altitudes contains dust particles from soil lifted by weather, volcanic dust, man-made aerosols, IDP (Interplanetary Dust Particles) - remnants of comets and asteroids, and even interstellar dust. Satellite observations suggest that approximately 100-300 tons of cosmic dust enter Earth's atmosphere every day. However, very little is known about the microbial life in the upper atmosphere, where conditions are very much similar to that on Mars and possibly on some exoplanets. Stratosphere provides a good opportunity to study the existence or survival of organisms in these conditions. Despite the importance of this topic to astrobiology, stratospheric microbial diversity/survival remains largely unexplored, probably due to significant difficulties in the access and ensuring the absence of contamination of the samples. To conduct a detailed study into this, we are developing the balloon-borne payload system SAMPLE (Stratospheric Altitude Microbiology Probe for Life Existence) to collect dust samples from stratosphere. This balloon-borne payload system will rise through the atmosphere till it reaches an altitude of about 25-30 km above sea level. The payload consists of detachable pre-sterilized sampling chambers designed to collect and contain the dust samples and get them back to the surface without contamination during the flight, a microprocessor and a controller which will determine the altitude of the payload system to actively control the opening and closing of the sample collection chambers. For contamination control, we will have two extra chambers, one of which will fly but not open, and the other will remain closed on the ground. Other on-board devices include environmental sensors, GPS tracking devices, cameras to monitor the balloons and an FTU (Flight Termination Unit) to terminate the flight after the payload has reached the desired height and on completion of the sample collection. A parachute attached to the payload ensures the safe descent of the payload on its way back to the surface. On retrieving the payload, the sampling chambers (including controls) will be sent to a suitable laboratory where the samples will be examined for the presence of biological matter.

CONTRIBUTORY TALK

Magnetically supported viscous accretion flow around a rotating black hole

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ABSTRACT

We investigate a single-temperature, magneto-fluid model for accretion disc around a rotating black hole in presence of dissipation. The accretion flow is assumed to be threaded by toroidal magnetic fields and synchrotron radiative mechanism is assumed to be the dominant cooling process. The global transonic solutions in the accretion flow are studied in terms of dissipation parameters, such as viscosity (αB) accretion rate (˙m) and plasma-β, respectively. In the rotating magnetized accretion flow, centrifugal barrier is developed in the nearby region of the black hole that triggers the discontinuous shock transition in the flow variables. Evidently, the shock properties and the dynamics of the post-shock flow (hereafter post-shock corona (PSC)) are being governed by the flow parameters. We study the role of dissipation parameters in the formation of standing shock wave and find that global shocked accretion solutions exist both in gas pressure dominated flows and in magnetic pressure dominated flows. In addition, we observe that standing shock continues to form around the rapidly rotating black holes as well. We identify the range of dissipation parameters that permits shocked accretion solutions and find that standing shocks continue to form even in presence of high dissipation limit, although the likelihood of shock formation diminishes with the increase of dissipation. Further, we compute the critical accretion rate (˙mcri) that admits shock and observe that standing shock exists in a magnetically dominated accretion flow when the accretion rate lies in general in the sub-Eddington domain. At the end, we calculate the maximum dissipated energy that may be escaped from the PSC and indicate its possible implication in the astrophysical context.

CONTRIBUTORY TALK

An Explanation of the Origin of Soft And Hard Lag in the Black Hole X-Ray Transients

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ABSTRACT

We study the timing properties of low (GX339-4, XTE J1650-500, XTE J1752-223, XTE J1817-330 etc.) and high inclination (H1743-322, XTE J1859+226, XTE J1748-288, XTE J1550-564, GRO J1655-40, GRS 1915+105 etc.) Galactic Black hole X-ray transients during their outbursts. We closely compare the evolution of timing properties of the sources in terms of Quasi Periodic Oscillation (QPO) frequency, time lag and RMS power of the power density spectrum. We study the energy dependence of time lag and QPO amplitude. We find that time lag is always positive (i.e., hard lag) for lower inclination objects and time lag switches from hard to soft for the higher inclination sources. We concluded that the evolution of QPO frequency is independent of the inclination of the source whereas time lag depends on the inclination. We explain the origin of Soft and Hard lag with possible accretion geometry.

CONTRIBUTORY TALK

Narrow Line Seyfert 1 galaxies: A new class of gamma-ray emitting AGN

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ABSTRACT

Observations with the Fermi gamma-ray space telescope has discovered a new class of gamma-ray emitting active galactic nuclei (AGN) namely the Narrow Line Seyfert 1 (NLSy1) galaxies. This discovery by Fermi points to the presence of relativistic jets in them. Considering that Seyfert galaxies are generally hosted in spiral galaxies, the discovery of gamma-ray emission in NLsy1 galaxies goes against the elliptical-jet paradigm that postulates relativistic jets as a feature of elliptical galaxies that are the hosts of blazars. Multi-wavelength observations that include optical, X-ray and gamma-ray energies indicate that the gamma-ray emitting NLSy1 galaxies have many properties similar to the blazar category of AGN. Recent results obtained on these enigmatic objects will be presented in this talk.

CONTRIBUTORY TALK

Microlensing due to Binary Black Hole

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ABSTRACT

Gravitational lensing of a background source due to binary system offers a powerful diagnostic of the lens. When Black Hole is involved, the light curve gets modified due to the non-negligible relative speed of the binary components as well as the strong gravity. The new feature of black hole binary is a "radial caustic", just a few days before the system merges. This has a characteristic light curve, observing which will be a sure signature of the impending gravitational wave emission due to merger with in next few days.

CONTRIBUTORY TALK

Enhancement in intensity of nightglow OI 630 nm emission due to the Milky Way Galaxy

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ABSTRACT

The regular observations of nightglow OI 630.0 nm emission have been made by all sky imager (ASI) at low latitude station Kolhapur (16.42°N, 74.2°E, and 10.6°N dip lat.), India. The large scale inonospheric irregularities such equatorial plasma bubbles (EPBs), can detect by these images and each image having 1024 X 1024 pixels. However, in the present work we have considered cropped images (5 X 5 pixel size) to determine the intensity of OI 630.0 nm emission. The average intensity is used to study the nocturnal variations in OI 630.0nm emissions. We have observed that, the intensity of OI 630.0 nm emission was abruptly increased during the occurrence of the Milky Way Galaxy in images. This result indicates that high energetic radiations are coming from the Milky Way Galaxy during the night time and due this nightglow may increase. We have also found that post-midnight enhancement in intensity of OI 630.0 nm as a result of the midnight temperature maximum (MTM) phenomenon. This MTM activity has been reported by several investigators as anomalous behavior of the neutral temperature of the F region during the nighttime has been reported from Indian and Brazilian sector. The occurrence of the galaxy in nighttime is an important source of an intermittent. This data is very important for the development of ionospheric models on ionospheric dynamics. This work may useful for investigating the interaction between extraterrestrial radiations and low latitude ionosphere.

CONTRIBUTORY TALK

Evolution of Accetion Flow Properties around Black Holes from Observations

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ABSTRACT

Observational astronomy of black holes started roughly 50 years ago in 60s. After that starting from early 70s, people tried to develop physical models to understand accretion processes around black holes as well as to understand various observational features. We believe that to find direct observational evidences of accretion flows around black holes, one needs to study them with a physical model. Although there are many phenomenological and theoretical models available in the literature, we believe that observational astronomy of black holes has changed significantly after the successful implementation of the two component advective flow solution (TCAF) into XSPEC as an additive table model to fit energy spectra. Accretion flow dynamics around black holes are now more transparent, since a spectral fit with this most generalized accretion flow solution directly provides us information about the flow parameters. Prediction of quasi-periodic oscillation frequencies, which is a timing feature, is also a reality from the TCAF model fitted shock parameters. One can also estimate black hole mass, spin, etc., which are intrinsic source parameters from spectral analysis with the TCAF solution. Estimation of X-ray contribution from jets or outflows are also possible from spectral analysis with the TCAF solution.

CONTRIBUTORY TALK

Tracing the low-mass star formation; complex molecule and hot-corino

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ABSTRACT

There is no universal theory to understand low mass and high mass star formation in a straightforward manner. The core accretion paradigm describes the low-mass star formation starting from the pre-stellar core, and as the collapse proceeds, it forms a single or binary protostar passing through the stages like accretion, jet, rotationally supported disk, etc. Although high-mass star may not evolve similarly as of low-mass star, high-temperature core (~100 K and higher) are well abundant of complex molecules(species with at least six atoms or higher) for both high and low mass protostars. For low-mass protostar, the hot-core which is enriched with complex molecules are often called hot-corino by astrochemist/astronomer. In this talk, we will summarize how complex molecules form and evolve for low-mass protostar system, and why this kind of study is necessary to understand our chemical heritage. Complex molecules which form during cold prestellar phase (~10 K) come out of the grain surface mainly due to thermal desorption in the hot-corino phase, thereby complex molecules often trace the formation of hot-corino. Though these molecules are hard to detect due to their low-abundance and small emitting region (such as sub-arcsecond region), thanks to ALMA (Atacama large millimeter array), due to its high sensitivity and angular resolution it is possible now. We will discuss some ALMA observation related to the hot-corino system such as HH212 and IRAS 4A as well in this talk.

CONTRIBUTORY TALK

Why do galaxies care about Asymptotic Giant Branch (AGB) stars?

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ABSTRACT

The chemical evolution of the galaxies is governed by the nucleosynthesis output from stars, which is primarily determined by the initial stellar mass. Asymptotic Giant Branch (AGB) stars are low mass stars (initial mass < 8 solar mass) which are at their later stages of evolution. They are the major contributors of crucial elements like Carbon, Nitrogen, Flourine and Lithium to the galaxy. Also they are identified to be one of the potential site for the occurrence of slow neutron-capture process (s-process), which is responsible for the production of half of the elements heavier than iron. Also very recently, they are even proposed as one of the potential site for the intermediate-process (i-process). Hence AGB stars play a major role in galactic chemical evolution. Detailed chemical analysis of AGB stars can thus provide strong constraints for the complex theories of galactic chemical evolution. In my presentation, I will be discussing about the role of AGB stars on the galactic chemical enrichment and how it varies depend on their mass and metallicity based on my recent papers Karinkuzhi et al. 2018b, A&A and Shetye+ Karinkuzhi et al. A&A, 2018.

CONTRIBUTORY TALK

Multi Fractal Analysis of Solar-Terrrestrial Environment

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ABSTRACT

Wavelet Transformation and other tools of Multi Fractal Analysis are used to analyze the time series of high energy particles in Solar Wind detected at 1AU and Geomagnetic Indices measured. The images of the cloud formed are also analyzed in order to use the existing correlations in predicting storms. Results obtained in the present study indicate that certain parameters of cloud formation may be used to probe and predict extreme environment as a result of Solar-Terrestrial interaction.

CONTRIBUTORY TALK

Study of Fine Structures in Solar Radio Emission

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ABSTRACT

Solar radio emission an be broadly categorized as : i) continuum emission and ii) transient emission. The former is composed of a non-variable thermal component considered to be due to the free-free emission from the inherent electron distribution in the corona and a 'slowly-varying' component due to the extreme density condensations above 'Active Regions'. At times the radio emission from the Sun can be impulsive in nature and are often referred as 'radio bursts'. The solar radio bursts are often identified and classified based on their spectro-temporal characteristics seen in the frequency-time plane. These transient phenomena are observed to occur over a broad range of frequencies from a few kHz up to a few GHz, and show very high brightness temperatures in the range 10 ^12 -10^14 K. The impulsive radiation is often associated with the solar transients, viz. Flares, Coronal Mass Ejections (CMEs), etc. which are the consequences of large scale magnetic energy releases that take place on the Sun. With the advent of digital technology and improved radio instrumentation techniques the next generation of very sensitive radio telescopes offer the capability of spectroscopic imaging observations covering many octaves of the radio frequency band with very high spectral and temporal resolution. This has resulted in the identification of new spectro-temporal phenomenology in emission features in the solar radio radiation which are also found to be very weak as compared with the strong impulsive bursts (viz Type I, II, III etc.). Such weak emission features have been found to occur particularly at times of minimal or no appreciable solar activity and are considered to be a key aspect in the understanding of the coronal heating phenomenon. In order to understand the physics of such phenomena it is important to have regular observations of the Sun with highly sensitive radio telescopes, which are presently very limited. Solar radio emission is highly dynamic, varying over time scales down to a few milliseconds and spectral scales down to a few kHz. High sensitivity radio telescopes (viz. UGMRT, MWA, MUSER) with instantaneous wide-band coverage with high spectro-temporal and angular resolutions are ideal for such observational studies, particularly during periods of low solar activity. In this talk, I will describe some of our recent high-resolution-observations of fragmented radio emission from the Sun and their usefulness in the understanding of the solar corona.

CONTRIBUTORY TALK

The 2004 outburst of BHC H1743-322: analysis of spectral and timing properties using the TCAF solution

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ABSTRACT

The black hole transient H1743-322 exhibited several outbursts with temporal and spectral variability since its discovery in 1977. These outbursts occur at a quasi-regular recurrence period of around 0.5-2 yr, since its rediscovery in 2003 March. We investigate accretion flow dynamics around the low-mass X-ray binary H1743-322 during its 2004 outburst using the RXTE (Rossi X-Ray Timing Explorer)/PCA archival data. We use two component advective flow (TCAF) solution to analyse the spectral data. From the fits with TCAF solution, we obtain day-to-day variation of physical accretion rates of Keplerian and sub-Keplerian components, size of the Compton cloud and its other properties. Analysis of the spectral properties of the 2004 outburst by keeping fitted normalization to be in a narrow range and its timing properties in terms of the presence and absence of quasi-periodic oscillations, enable us to constrain the mass of the black hole in a range of 10.31 M_{Sun} - 14.07 M_{Sun} that is consistent with other estimates reported in the literature.

CONTRIBUTORY TALK

LAXPC / AstroSat Study of ~ 1 and ~ 2 mHz Quasi-periodic Oscillations in the Be/X-ray Binary 4U 0115+63 During its 2015 Outburst

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ABSTRACT

The Be X-ray Binary 4U 0115+63 was observed by Large Area X-ray Proportional Counter (LAXPC) instrument on AstroSat on 2015 October 24 during the peak of a giant Type II outburst. Prominent intensity oscillations at ~ 1 and ~ 2 mHz frequency were detected during the outburst. Nuclear Spectroscopic Telescope Array (NuSTAR) observations made during the same outburst also show mHz QPOs. Details of the oscillations and their characteristics deduced from LAXPC/AstroSat and NuSTAR observations are reported from 2015 outburst.

CONTRIBUTORY TALK

Results from studies of X-ray sources with Astrosat

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ABSTRACT

X-ray instruments on-board Astrosat were extensively used for simultaneous spectroscopic, timing and imaging studies of compact objects. Interesting results obtained from our studies of some of these objects particularly, Supernova remnants, Magnetars and X-ray pulsars would be presented and their implications on our current understanding would be discussed.

CONTRIBUTORY TALK

Possible Images of Sgr A* under Two Compnent Advective Flow Paradigm

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ABSTRACT

The supermassive black hole at our Galactic center accretes matter from the surroundings at a relatively lower accretion rate. Due to the insufficiency of matter, flow is mostly halo dominated. And, the emergent radiation is much lower compared to the other AGNsmaking it Low Luminosity AGN (LLAGN). We performed viscous hydrodynamical simulation where sub-Keplerian material with variable accretion rate have been injected. Radio spectral variation due accretion rate and inclination angle are reported. A catalogue of images with various mass and halo rate are generated.

CONTRIBUTORY TALK

Long-term X-ray variability characteristics of the narrow-line Seyfert 1 galaxy RE J1034+396

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ABSTRACT

We present the results of our study of the long-term X-ray variability characteristics of the narrow-line Seyfert 1 galaxy RE J1034+396. We use data obtained from the AstroSat satellite along with light curves obtained from XMM-Newton and Swift-XRT. We use the 0.3-7.0 keV and 3-20 keV data, respectively, from the SXT and the LAXPC of AstroSat. The X-ray spectra in the 0.3-20 keV region are well fitted with a model consisting of a power law and a soft excess described by a thermal Compton emission with a large optical depth, consistent with the earlier reported results. We have examined the X-ray light curves in the soft and hard X-ray bands of the SXT and LAXPC, respectively, and find that the variability is slightly larger in the hard band. To investigate the variability characteristics of this source at different time-scales, we have used X-ray light curves obtained from XMM-Newton data (200 s to 100 ks range) and Swift-XRT data (1 to 100 d range) and find that there is evidence to suggest that the variability increases sharply at longer time-scales. We argue that the mass of the black hole in RE J1034+396 is likely to be ?3 ? 10^6 $M_\odot$, based on the similarity of the observed quasi-periodic oscillation (QPO) to the high-frequency QPO seen in the galactic black hole binary GRS 1915+105.

CONTRIBUTORY TALK

COSMOS-DASH: Size-Mass relation of galaxies since z~3

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ABSTRACT

We present COSMOS-Drift And SHift (DASH), a Hubble Space Telescope WFC3 imaging survey of the COSMOS field in the H_160 filter. The survey comprises 456 individual WFC3 pointings corresponding to an area of 0.49 deg^2 (0.66 deg^2 when including archival data) and reaches a 5 point-source limit of H_160 =25.1 (0".3 aperture). COSMOS-DASH is the widest HST/WFC3 imaging survey in H_160 filter, tripling the extragalactic survey area in the near-infrared at HST resolution. We make the reduced H_160 mosaic available to the community. We use this dataset to measure the sizes of 162 galaxies with log(M_star/M_sun) > 11.3 at 1.5 < z < 3.0, and augment this sample with 748 galaxies at 0.1 < z < 1.5 using archival ACS imaging. We find that the median size of galaxies in this mass range changes with redshift as r_eff = (10.4+/-0.4)(1 +z)^(0.65+/-0.05) kpc. Separating the galaxies into star forming and quiescent galaxies using their restframe U-V and V-J colors, we find no statistical difference between the median sizes of the most massive star-forming and quiescent galaxies at z = 2.5: they are 4.9+/-0.9 kpc and 4.3 +/-0.3 kpc respectively. However, we do find a significant difference in the S`ersic index between the two samples, such that massive quiescent galaxies have higher central densities than star forming galaxies. We extend the size-mass analysis to lower masses by combining it with the 3D-HST/CANDELS sample of van der Wel et al. (2014), and derive empirical relations between size, mass, and redshift. Fitting a relation of the form r_eff = A m_star^a, m_star = M_star/5x10^10 M_sun and r_eff in kpc, we find log A = -0.25 log (1 + z) + 0.79 and a = -0.13 log(1 + z) + 0.27. We also provide relations for the subsamples of star forming and quiescent galaxies. Our results confirm previous studies that were based on smaller samples or ground-based imaging.

POSTER

Explaining the observed large variations in the projected jet-position-angle of OJ 287 using its binary black hole central

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ABSTRACT

OJ 287 is one of the most highly variable BL Lac objects at optical and radio wavelengths. The availability of optical R-band data from the late nineteenth century and the repeated occurences of quasi-periodic optical outbursts with period ~ 12 years led to the proposal that this unique blazar is hosting a massive black hole binary (BBH) central engine. According to the refined BBH model, OJ 287 contains a super-massive binary black hole system where a secondary BH (150 million solar mass) is orbiting around the primary spinning BH (18 billion solar mass) in a precessing and inspiraling eccentric orbit with an orbital period of 12 years. Detailed high frequency radio observations reveal a wobbling parsec-scale jet and the projected jet-position-angle (PA) on the sky plane display temporal variations and sudden large angle jumps. These variations can arise from the changes in the direction of the jet which is determined either by the primary BH spin or the angular momentum of the inner region of the accretion disk. The on-going detailed efforts indicate an excellent agreement between the observed temporal variations in OJ 287's jet PA and our theoretical modeling based on the BBH central engine scenario.

CONTRIBUTORY TALK

Study of Geology of Doppelmayer Crater Using High-Resolution Datasets from Recent Lunar Mission

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ABSTRACT

Doppelmayer crater (41.507ºW - 28.478ºS) is located towards the near side of the Moon, on the southwest peripheral edge of Mare Humorum basin. It is having a diameter of about 63 km and depth 1.6 km and belongs to class of fractured floor crater of Nectarian age. It is nearly rounded but highly worn and eroded complex crater characterized by central peak in form of central raised ridge and concentric fractures. The interior of the crater is flooded by basaltic flows and covered by dark pyroclastic deposits. The southwest half of the crater is intact while its northeast rim descends beneath the mare. Present study is intended to understand the geology of this fractured-floor crater using high-resolution datasets from recent lunar missions. In this study for morphological analysis we have utilized data of Terrain mapping camera (TMC) from ISRO's Chandrayaan-1 mission and Narrow Angle Camera (NAC) from NASA's LRO (Lunar Reconnaissance Orbiter) mission. Elevation data from Lunar Orbiter Laser Altimeter (LOLA) along with Wide Angle Camera (WAC) both from LRO mission have been used to study topology of the area. For mineralogical mapping of the study area we have used data of Moon Mineralogy Mapper (M^3) from ISRO's Chandrayaan-1 mission and for characterization of iron and titanium concentration in the area WAC map have been used. Morphologically Doppelmayer crater is showing diverse nature with prominent fracture system on its floor, degraded rim, pyroclasts, lava flows etc. It shows abundance of pyroclastic deposits. It is also compositionally of diverse nature with evidence of several mineral in form of spectral signatures of various mafic minerals like pyroxenes, olivine, spinel, plagioclase.

CONTRIBUTORY TALK

Near-Ultraviolet Astronomical Observations from the Moon: Lunar Ultraviolet Cosmic Imager (LUCI)

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ABSTRACT

Earth atmosphere absorbs and scatters UV photons preventing observations of the active Universe. High-energy events are all UV-emitting phenomena: massive star formation, hot transients such as supernovae (SNe), which are UV bright for hours to days, AGN where the variability amplitude usually increases at shorter wavelengths, M-dwarfs with UV-flaring activity on time scales of hundreds of seconds, flashes from cosmic collisions which can be very energetic on all scales. The UV range is a critical tool for classifying and studying these hot transients. We are in collaboration with the Team Indus, Axiom Research Lab (an Indian aerospace startup) to fly an astronomical instrument on-board the Team Indus Lunar lander to the Moon. Team Indus was an Indian entry to the Google Lunar XPRIZE competition. Though the competition is cancelled officially, as a startup they are continuing with their plans to fly the lander, rover, and associated scientific experiments to the Moon. We have chosen a wide-field UV telescope --- Lunar Ultraviolet Cosmic Imager (LUCI), operating in the near-UV (NUV) range of 200--320 nm, taking advantage of the transparency of the lunar sky to the UV. There is an increasing awareness of the opportunities available for science tailored to CubeSats and piggy-back missions with the possibility of accomplishing limited but essential science goals. The Lunar Ultraviolet Cosmic Imager (LUCI) is an innovative all-spherical mirrors telescope designed to take advantage of these opportunities. Our primary science goals are detection of transients such as, for example, tidal disruption events, or SNe in distant galaxies as a probe for cosmological distant scale. As we perform our survey of the sky, we will also pick up other transients such as near-Earth asteroids, as well as produce an NUV catalog of the sky. We will also map the hot stellar distribution in the Galactic disk. LUCI is an all spherical mirrors telescope with a field of view of 0.46° x 0.34°, and a weight of only 1.2 kg. No other UV space payloads have been previously reported with an all-spherical optical design for imaging in the NUV domain and a weight below 2 kg. The detected events will be processed and stored onboard, and send back to Earth whenever the radio link is available. The required power for the detector will be provided by the lander, where solar panels are the primary source of energy during the lunar day surface operations, therefore LUCI will only operate in the daytime. The processing and analysis of the obtained data will be performed by the students and will be open to the public as soon as the processing is done. This way, LUCI can be straight away engaged in the citizen science program that we are in the process of organizing at the Institute.

CONTRIBUTORY TALK

AstroSat observations of Cyg X-3

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ABSTRACT

I shall discuss results from the AstroSat observations of Cyg X-3.

CONTRIBUTORY TALK

Simulation of High Frequency Quasi-periodic Oscillations (HFQPOs) around rotating black holes

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ABSTRACT

We perform a hydrodynamical simulation to study high-frequency quasi-periodic oscillations (HFQPOs) from advective, inviscid accretion flow around rotating black holes. The space-time geometry around rotating black hole is modeled using pseudo-Kerr potentials. The time-dependent differential equations are numerically solved by explicit-implicit finite difference method scheme under the initial and boundary conditions. In this work, we consider only the free-free emission (i.e., Bremsstrahlung) to calculate the luminosity from the disc. We observe that several model parameters yield HFQPOs (νQPO$\geq$40) Hz based on our shock oscillation model. We also apply our simulation model to a particular source GRS 1915+105 based on the recently observed HFQPOs $\sim$68.06 Hz using {\it AstroSat}. Interestingly, we observe that higher spin parameter values (ak>0.92) exhibit HFQPOs for the source GRS 1915+105 from our model.

CONTRIBUTORY TALK

Cosmology using Long Gamma Ray Bursts: Statistical Analysis ofErrors in the calibrated Data

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LUCKNOW

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ABSTRACT

We investigate non-Gaussian features in the High-z cosmological data using the Δstatistic and Kolmogrov Smirniov test. These techniques are applied on a set of calibratedLong Gamma Ray Bursts (GRB) and its combination with the latest Type Ia Supernovae data(Union2). Our statistical analysis shows a weak but consistent direction dependence in boththe data sets. The analysis also indicates non-Gaussian nature of errors in both data sets.

CONTRIBUTORY TALK

A New Set of Binding Energies for Astrochemical Modeling

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ABSTRACT

Icy grain mantles are the main repository of the complex organic molecules (COMs) in the interstellar medium (ISM). Such icy mantles constitute the main reservoir of volatiles in clouds, protostellar envelopes, comets, and protoplanetary disks. Ices form by a condensation of atoms and molecules from the gas-phase and subsequent grain surface chemistry. Hydrogenation reactions initiate the complexity of interstellar grain mantle in molecular clouds (at temperature ~10 K). Since the chemical composition of interstellar grain mantle is mostly dependent on adsorption energy (also known as binding energy) of the surface species, it's a key to study the formation of more complex molecules on interstellar grain surfaces. The inadequate knowledge of the binding energy (BE) of interstellar species with dust grains is one of the major obstacles to accurately model the interstellar chemistry. In denser regions of molecular clouds, where very complex chemistry is active, interstellar dust is predominantly covered by water molecules, thus it is essential to know the interaction of gas-phase species with water ice to trace realistic physical and chemical processes. To this end, we consider water (cluster) ice to calculate the BE of several atoms, molecules, and radicals of astrochemical interest. Systematic studies have been carried out to come up with a relatively more accurate BE of astrophysically relevant species on water ice. We increase the size of the water cluster methodically to capture the realistic situation. Sequentially, one, three, four, five, and six water molecules are considered to represent the water ice analogs in increasing order of complexity. We note that for most of the species considered here, as we increase the cluster size, our calculated BE value starts to converge toward the experimentally obtained value. More specifically, our computed results with the water c-pentamer (average deviation from experiment ~ 15.8%) and c-hexamer (chair) (average deviation from experiment ~ 16.7%) configurations are found to be nearer to an experimentally obtained value other than the value found for the smaller water clusters we consider.

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CONTRIBUTORY TALK

Star Formation in the Outer Disks of Galaxies and its Implications for Galaxy Evolution

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ABSTRACT

We present UV observations of star formation in the Extended Ultraviolet Disks (XUV) of nearby galaxies using the Ultraviolet Imaging telescope (UVIT). XUV galaxies show filamentary or diffuse star formation in regions well beyond their optical disks, that lie within the halo dominated regions of galaxies. The XUV star formation maybe driven by gas accretion from the intergalactic medium, infall of high latitude clouds onto galaxy disks or by interactions with companion galaxies. The nature of XUV star formation is different from normal galaxies as the outer disk environment is metal poor and the stellar surface density is far lower than that of the inner disk. Early studies found that 30% of all nearby spiral galaxies have XUV disks, which suggests that XUV star formation is not rare. The galaxies can be classified into two broad classes; in Type~1 XUV disks the XUV star formation is a continuation of that in the inner disk whereas Type~2 XUV disks have low surface brightness stellar disks that are rich in UV emission. The two classes can be interpreted as being due to slow and fast gas accretion. In this meeting we present UVIT observations of XUV galaxies, discuss the nature of the star formation and also the origin of star formation in the halo dominated regions of spiral galaxies.

CONTRIBUTORY TALK

Compton driving of astrophysical jets and association with their observed features

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ABSTRACT

We study radiation driving of relativistic jets in general relativistic regime. Compton scattering has been considered to deal with interaction between radiation and jet. Compton scattering enables radiation field to transfer momentum as well as energy on to the jet matter leading to their mechanical acceleration as well as heating. We show that the obtained Lorentz factors of the jets fall in the range that is observed for relative luminosities of the accretion discs. We also discuss the observed significance of obtained internal shocks to account for observed features of radio sources. A connection of Compton heating of jets is discussed with the obtained brightness temperatures of the radio loud AGNs.

CONTRIBUTORY TALK

Continuous Jet Leptonic model for Blazars - A Monte Carlo study

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ABSTRACT

The broadband spectra (or spectral energy distribution SED) of blazar is extended from radio to gamma-ray energy band. The radio observations of blazar establish that blazar have core-jet structure, and the observed apparent superluminal motion of jet show that radio-emitting plasma (synchrotron-emitting electrons) has relativistic speed and beamed towards the observer. It is believed that gamma-ray emission is due to the same relativistic electron population which is responsible for radio. Also during the gamma-ray flaring the core radio emission is correlated with gamma-ray emission. We aim to discuss a model for blazars SED in continuous jet scenario (i.e., relativistic electrons are in outflow which is contrary to the favourable "one-zone model"), where the radiative process for lower peak of the blazar SED (in νFν plot) is a synchrotron emission and high-energy peak is due to a inverse Compton process (similar to the one-zone model). In addition to the outflowing relativistic electrons we assume that these electrons also have comparatively low random speed. As we are dealing with two components of electrons velocity simultaneously, so for inverse Compton process we consider a generalized bulk Comptonization (in this formalism, both velocities can have random directions). For computing the generalized bulk Comptonized spectra we adopt a Monte Carlo methods, and we limit the calculations for the low value of average scattering number (< ~1.05). We will show that in this model the rate of pair-production is comparatively very lower than the Comptonization, like one-zone model. We estimate the magnetic field strength by fitting the SED (other than equipartition methods). We compare the model results with observed SED of blazars, e.g., FSRQs (flat spectrum radio quasars), BL Lac objects (intermediate BL Lac, High-frequency peaked BL Lac). In particular, in case of FSRQs to explain the gamma-ray variability time-scale (say, ~10 hours) the required electron density of the gamma-ray emitting region should be greater than ~$10^{14}$$m^{-3}$.

CONTRIBUTORY TALK

Unmasking the dark galaxies

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ABSTRACT

The 'missing satellite problem' is a longstanding issue in the Lambda-CDM cosmological model. In spite of recent progress in both theory and observation front, the number of observed satellite galaxies around large galaxies still fall short than what is predicted. Out of the many proposed solutions, the 'HVC-minihalo' hypothesis is one of the promising ones. In this hypothesis, the local volume Compact High-Velocity Clouds (CHVC) represent a population of primordial satellite galaxies. Using HI observation and exploiting a prevailing hydrostatic condition, I formulate a technique to identify the potential satellite galaxies from the population of CHVCs. I also applied this technique to a recently discovered dwarf galaxy Leo T to show that its hydrostatic structure is not consistent with no dark matter in it (hence it is a minihalo). Using a Monte Carlo approach, we also estimate the dark matter halo parameters of Leo T.

CONTRIBUTORY TALK

Investigation of Magnetic Field Configuration of typical and atypical Confined Flares

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ABSTRACT

Atypical flares cannot be naturally explained with standard models. So as to be able to predict such flares, we need to define their physical characteristics, in particular, their magnetic environment, and identify pairs of reconnected loops. Here we present in detail a case-study of a confined flare preceded by the flux cancellation that leads to the formation of a filament. The slow rise of the non-eruptive filament favours the growth and reconnection of overlying loops. The flare is only of C5.0 class but it is a long duration event. The reason is that it comprises of three successive stages of reconnection. A non-linear force-free field extrapolation and a magnetic topology analysis allow us to identify the loops involved in the reconnection process and build a reliable scenario for this atypical confined flare. The main result is that curved magnetic polarity inversion line in active regions is a key ingredient for producing such atypical flares. Comparison with previous extrapolations for typical and atypical confined flares leads us to propose a cartoon for generalizing the concept.

CONTRIBUTORY TALK

Swift and XMM-Newton monitoring of the TeV blazar PG 1553+113

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ABSTRACT

PG 1553+113 is a very bright BL Lac object emitting enormously in the complete electromagnetic spectrum. The source grab attention of the community when a periodicity of 2.18 ± 0.08 years was detected in simultaneous γ-rays, optical and radio observations (Ackermann et al. 2015), which indicates possible existence of SMBH binary system at its center. We have investigated the temporal and spectral behavior of the source in the energy range 0.3-10 keV in different activity states during 2015 - 2017 with XRT and Epic-pn instruments on board the Swift and XMM-Newton satellites, respectively. During the high phase significant variability in the flux has been detected, where variation occurs less than an hour. The continuum emission from the source is generally best described by a log-parabolic model. Study of spectral evolution of PG 1553+113 reveals a clear harder-when-brighter trend.

CONTRIBUTORY TALK

Extragalactic Science Results with integral field spectrographs: GMOS and MUSE

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ABSTRACT

Integral field spectroscopy (IFS) has revolutionised the field of astronomy as it provides a three-dimensional view of extended objects, like planetary nebulae, star-forming regions, galaxies, clusters of stars and galaxies. IFS is the best available technique to study the galaxies hosting star-forming regions, because it not only allows us to access information encoded in the emission lines from the star-forming regions, but also enables us to map their distribution and varying properties throughout each system. I present the extragalactic science results using two IFS facilities, Gemini Multi-Object Spectrograph (GMOS) employing fibres and lenselets and Multi Unit Spectroscopic Explorer based on the image-slicer technique. I present IFS observations from the GMOS to study the distribution of physical and chemical properties of H II regions in a sample of Blue Compact Dwarfs, the local analogues of high redshift galaxies. I also discuss results from the analysis of the IFS observations of nearby spiral galaxies from the MUSE, where have devised metallicity calibration for diffuse ionised gas applicable to a wide variety of galaxies. The eventual aim of such studies is to shed light on several secrets of the key mechanisms involved in galaxy formation and evolution.

CONTRIBUTORY TALK

Variability Properties of Seyfert 1 AGN: Mrk 493 and Zw 229.015 as case studies

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ABSTRACT

By using archival data (from optical/UV to X-ray) of the nearby Seyfert 1 AGN Mrk 493 and Zw 229.015, we study both the spectral and temporal properties of the central black holes in remarkable detail. The energy spectra show soft excess emission (much stronger and variable for Mrk 493) which is consistent with both inverse Comptonization from a cold corona and relativistically blurred reflection close to the black holes. The UV/X-ray data of Mrk 493 show good correlation between the variability in both bands. Cross-correlation analysis reveal that variations in the UV emission lead the X-ray emission and the measured time lag is consistent with the Comptonization scenario where disc UV seed photons are Compton-upscattered in the corona into the observed X-rays. For Zw 229.015, from the time lag estimate between the soft and the hard X-rays, we compute the size of the corona system to be about 20Rg. On longer time-scale using the Swift archival data of Zw 229.015, a time delay between the UV and the X-ray emission could not be established with certainty although apparently the source appears to be brighter in UV when softer in X-rays.

CONTRIBUTORY TALK

No evidence for additional planet in the Extra-solar Planetary System TrES-3

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ABSTRACT

We present twelve new transit light curves of the extra-solar planetary system TrES-3 observed using the various observatories available in India as well as in abroad during 2012-2018. In addition to these twelve newly observed transit data, the seventy four transit light curves available in the literature are considered to determine the physical and orbital parameters using Transit Analysis Package (TAP). The refined ephemeris for orbital period and mid-transit time are estimated with these total numbers of eighty six light curves and utilized to plot the observed minus calculated mid-transit time, i.e., (O-C) as a function of epoch to examine the possible transit timing variation (TTV). It is found that the null-TTV model provide the poor fit to the (O-C) data with χ^2_{Red} = 2.88 indicating the possible transit timing variation (TTV) in this extra-solar planetary system. The Generalized Lomb-Scargle Periodogram is employed to check the periodicity in the obtained TTV signal that would be due to presence of additional planet in this extra-solar planetary system. The false alarm probability (FAP) corresponding to the highest power in the Lomb-Scargle Periodogram was found to be 60% which is much below the threshold value (i.e., FAP = 5%). It is, therefore, concluded that there is no evidence for the additional planets in the extra-solar planetary system TrES-3. Since non periodic TTV can also be produced by the orbital decay due to tidal interaction between extra-solar planet and its parent star, it is important to examine for this system in future.

Keywords: planetary systems - stars - individual (TrES-3) - technique - photometry

CONTRIBUTORY TALK

Accretion Flow Geometry Evolution around Black Holes

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ABSTRACT

Low Mass X-ray Binaries are the end products of stellar evolution. Due to advancement of observational instruments LMXBs came up as enigmatic sources for their interesting variabilities. The variabilities are believed to be the reason for the variation in Two Component Accretion Flows. The accretion flow variation results the variation in geometry of the accretion disc. The variable observational evidences from LMXBs (e.g. GRS 1915+105, IGR J17091-3624, GRO J1650-44, GX 339-4 etc.) are analysed with the dynamically determined energy bands, obtained from the analysis, instead of traditional hardness ratio with fixed energy bands. This approach explained the geometry of accretion flow variation near the compact object through a mass independent general picture.

CONTRIBUTORY TALK

Quasi-periodic oscillations from post-shock accretion column of polars

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ABSTRACT

Polars are a set of strongly magnetized accreting white dwarfs which does not form any accretion disk due to its extended magnetosphere. Quasi-periodic oscillations (QPOs) with frequency about a Hz are detected in many optical observations of a few polars. In these binary systems, the high-frequency QPOs are thought to be generated due to the variation in emitted radiation from the post-shock accretion column. Thermal bremsstrahlung is a significant process to generate Xray radiation from this post-shock region. Local thermal instability due to the efficient cooling from the highly dense region is believed as the primary region behind the temporal variability. We study the structure and the dynamical properties of the post-shock accretion column including the effects of bremsstrahlung and cyclotron radiation. We find that the presence of significant cyclotron emission in optical band reduces the overall variability of the post-shock region. These characteristics of the post-shock region are consistent with the observed properties of V834 Cen and in general with Cataclysmic Variable sources that exhibit QPO frequency of about a Hz.

CONTRIBUTORY TALK

Link between Interstellar and Comeatry Sulfur Bearing Species

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ABSTRACT

Despite the lower elemental abundance, sulfur has significant role in the interstellar chemistry. Sulfur-bearing molecules are used to investigate the physical property, chemical history, and determine the age of a star-forming region. The major sulfur reservoir of the Interstellar medium (ISM) is a long-standing mystery. A large variety of abundances of sulfur-bearing molecules observed towards high-mass and low mass star forming regions. Quantum chemical method has been employed to study the reaction mechanisms and spectroscopic properties of complex sulfur species. Here, we will discuss the abundances of various simple and complex sulfur species for both high mass and low mass star forming regions using gas-grain chemical model. Comparisons between modeling and observation will be made. Sulfur-bearing molecules have also been observed in different comets. Finally, we will discuss the sulfur connection between ISM and comet.

CONTRIBUTORY TALK

Possible manifestation of shock oscillations in presence of a large scale magnetic field as high-frequency QPOs

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ABSTRACT

Shock oscillation in the accretion flow is one of the plausible mechanisms behind the quasi-periodic oscillations (QPOs) observed in the light curves of X-ray binaries. We study the effects of a large scale magnetic field on the shock oscillations and its possible manifestation as high frequency (HF) QPOs. We consider a very idealized model of axisymmetric non-rotating accretion flow. We find an advective-acoustic mechanism is responsible for the shock oscillations instead of a purely acoustic one. The large scale magnetic fields add more features to the oscillation patterns giving rise to a low frequency modulation in the computed light curve. While the oscillation frequency can be correlated with the upper kHz QPOs, we propose that the modulation frequency can be related to the hHz QPOs. Lower kHz QPOs can be connected to the beat frequency of the shock oscillation frequency and modulation frequency.

CONTRIBUTORY TALK

Kinematics and Structure of Young Star Clusters in the Gaia Era

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ABSTRACT

We study a sample of nine young clusters for which early mass segregation has been reported in literature using GAIA DR2, 2MASS, Spitzer, Chandra data. We study the kinematics and mass segregation in these clusters by finding the mass function $\phi(M)=dN/dM \propto M^{-\alpha}$ in different regions of the cluster and tracing the variation in the value of α as a function of the parameter $\tau=t_{age}/t_{relax}$ (where t_{age} is the age of the cluster and t_{relax} is the relaxation time of the cluster). We explore relations of various observational parameters like Galactocentric distance, intracluster reddening, age and size of the clusters to look for common defining features or signatures in them to help differentiate if the process is dynamical or related to their formation process. We also derive velocities and velocity dispersions to study the dynamical state of these clusters.

CONTRIBUTORY TALK

Origin of Heavy Elements in the Early Galaxy

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ABSTRACT

Metal-poor stars of $\lesssim 0.8\,M_\odot$ that have [Fe/H]$\sim\lesssim -2.5$ are thought to have formed within $\sim$1 Gyr after the Big Bang. Because of their low mass, they have very long lifetimes and are still around today. Surface composition of these stars are a fossil record of interstellar gas in the early Galaxy from which they were formed and are crucial for studying the early Galactic and chemical evolution. Abundance pattern of elements observed in these stars provide a unique probe of studying the nucleosynthesis and understanding the nature of the first and early supernovae. Interestingly, elements heavier than Fe group such as Sr, Ba, and Pb, that are primarily produced by neutron capture processes, are ubiquitous in these stars. Furthermore, their abundance patterns show a large variation that seem to indicate that all types of neutron capture processes, *r*apid, *i*ntermediate, and *s*low, operated in the early Galaxy. The sites for neutron capture process that can operate at such early times however, is still a puzzle. I will discuss the current status about the sites heavy element synthesis in the early Galaxy including latest results from my work on *i* and *s* process in early massive stars.

CONTRIBUTORY TALK

Spectral state dependence of the accretion disc absorption in MXB 1658-298

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ABSTRACT

We present the broadband spectral study of the neutron star low mass X-ray binary MXB 1658-298 with the Swift/XRT and NuSTAR observations made during its 2015-2016 outburst. The NuSTAR data showed the source to be in low/hard state during 2015 observation, and it was in high/soft state during the 2016 observation. The X-ray luminosity was found to be a factor of ~4 more during the latter observation. The hard state spectrum is well described with a single-temperature blackbody and Comptonized disc, whereas the soft state spectrum consists of disc blackbody and Comptonized blackbody components. We will also discuss the indicators of a probable connection between accretion disc wind (or atmosphere) and spectral state of MXB 1658-298.

CONTRIBUTORY TALK

The two-dimensional disk structures around black holes

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ABSTRACT

We have solved steady-state, axisymmetric viscous two-dimensional (2D) fluid equations of motion for accretion and outflows in spherical polar coordinates (r, θ, φ) with assuming non-zero two azimuthal components of the viscous stress tensors namely, τ_{rφ} and τ_{θφ}. Firstly, we investigated the flow parameters for the different size of global transonic advection-dominated accretion flow (ADAF) solutions along with an r-direction on an equatorial plane. We used the flow parameters corresponding to the ADAF solution and found out the radial flow variables and their derivatives at each step size along r-direction, with using symmetric boundary conditions on the equatorial plane and calculated initial values of polar flow variables for integration along θ-direction at each radial distance. Thus, we got a complete 2D disk structure with/without outflows around a black hole (BH) by the integration along both r- and θ-directions. We found that supersonic and subsonic regions in the inflow region and the outflows occurred in the subsonic inflow region above the equatorial plane. We also found that the structure and size of the 2D disk are affected by the viscosity of the flow and the ADAF size of the disk. We also explored the outflows, no outflows, and failed outflows solutions around the BHs.

CONTRIBUTORY TALK

Grid Model of Novae

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ABSTRACT

We present here a method to estimate physical parameters of novae systems using an extensive grid photoionization model for novae.We use the photoionization code CLOUDY to construct grid of models covering a wide range of different parameters, e.g. total hydrogen density (nH), source temperature (TBB) and luminosity (L), inner radius (Rin) and thickness of ejecta (DR), keeping other elements at solar metallicity. In this way, a total of 1792 models have been generated. From the model generated spectra which cover a wide wavelength region from ultra-violet to infrared, we calculate ratios of hydrogen and helium emission lines fluxes which are generally strong in novae spectra.We show that physical parameters associated with novae system could be estimated by comparing these line ratios with those obtained from observed spectra.We elaborate the idea with examples and estimate the parameter values in case of few other novae. The results of the grid model are available online.

CONTRIBUTORY TALK

Light Scattering Properties of Astrophysical Dust -- Recent Developments

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ABSTRACT

Its is well known that the interstellar dust plays the most important role in which the light seen form stars suffers extinction. Conventional models assume Mie theory of light scattering with solid spheres and other shapes of silicate and graphite particles of different sizes. An extension of this theory was Effective Medium Theory (EMT) which tries to explain some of the observed interstellar properties. Recent space probes have confirmed that the dust grains are highly porous and fluffy (i.e. aggregates or clusters) rather than having regular shapes (spherical, cylindrical or spheroidal) and homogeneous in composition and structure. Since there is no exact theory for calculation of scattering properties of such irregular, inhomogeneous particles, our group has used Discrete Dipole Approximation (DDA) method and the results of this will be discussed. The model uses a composite fluffy dust grain for explaining most of the observed interstellar extinction curves and also polarization. Another parameter which needs to be constrained by the dust models is the interstellar abundances of Carbon and Silicon which is usually overestimated by the solid dust models but our model predicts closer match to the observed ISM abundances. Further, our composite dust model also explains the IR emission from circumstellar dust. New results on NIR polarimetry will also be presented.

CONTRIBUTORY TALK

SN 2015ba: a case study of a Type IIP supernova with a long plateau

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ABSTRACT

Type IIP Supernovae are the hydrogen rich explosions in massive stars exhibiting a roughly constant luminosity phase in their light curve. One of the outstanding issues in this field is to map supernova explosions to progenitor systems, to gain better insights of the stellar evolution process. The nature of the progenitor system, in turn, governs the observed properties of supernovae, such as the light curve and spectra. In this work, we will present the analysis of a type IIP SN 2015ba, which continues in its plateau phase for a longer time (~123 days) than most SNe IIP. The longer plateau phase indicates that the progenitor has undergone minimal mass loss prior to explosion. The mass of the progenitor of SN 2015ba estimated from analytical modelling is about 24 Msun. This value seems to indicate a progenitor mass clearly higher than the observational limit of 16.5 ± 1.5 Msun of the Type IIP events that raised the so-called 'RSG problem'.

CONTRIBUTORY TALK

How Solar Jets Can Trigger the Filament Eruption

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ABSTRACT

We present here the observations of filament euption during March 14-15, 2015 using the data from Solar Dynamics Observatory (SDO) and ground based GONG instrument H-alpha data. The filament was disturbed on 14 March by the jet originated form the edge of the active region. As a result of this the filament reached some height (approx 125 Mm.) from its original position and becomes stable for 12 hrs. Further this filament was again pushed by the another jet on 15 March and finally it was erupted. We explore the possibility of trigger mechanism for this eruption. Based on the decay index calculation, we found the Torus Instability was the possible mechanism for this eruptions. Moreover, We believe that the jets eruption in the filament direction also made an important contribution for the eruption of filament.

CONTRIBUTORY TALK

Viscous dark energy accretion: threshold drop in accretion density profile

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ABSTRACT

It is almost a period of twenty years of now since we inferred from the distant SNe Ia observations that our universe is experiencing a late time cosmic acceleration. Major part of the works which have tried to justify this exotic incident in the background of Einstein's general relativity has considered the universe to be filled up by a homogeneous imaginary fluid exerting negative pressure in present time. Generalised chaplygin gas is one among the models of such fluids popularly coined as quintessence/phantom energy/dark energy. We consider a viscous flow of generalised chaplygin gas on a rotating black hole. Keeping parity with the existing works on non viscous dark energy accretion's property that the wind will be strong enough to throw matter out from the disc, we wish to analyse the properties of viscous dark energy accretion on rotating black holes. We analyse the effect of rotating parameters, viscous coefficient parameter and dark energy EoS parameter on the flow. We observe that there exist a threshold kind of drop in the density profile through the accretion branch.

CONTRIBUTORY TALK

Heavy Transuranium Elements and Their Beta Decay Properties by R-Process Nucleosynthesis During Explosion of Supernova Type Ii : A Theoretical Perspective

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ABSTRACT

Dynamical astrophysical event like Supernova is believed to be one of the most probable site for the production of heavy elements by r-process nucleosynthesis. Here at extremely high temperature and density, the neutron capture is much faster than beta decays and heavy and superheavy neutron rich elements are formed which are otherwise not possible by fusion reactions. Here we discuss a model for production of heavy elements along the rapid neutron capture (r-process) path during explosion of supernova type II. For most of the heavy and superheavy elements produced here, the experimental information is largely scarce. So a theoretical approach is considered essential for gathering information on the nuclei produced in such environments. Stars in the mass range 10-30 $M_{\odot}$ evolve to form iron cores of 1.3 to 1.6 $M_{\odot}$. 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. Astrophysical parameters needed for our analysis are temperature (> 10^9 degrees K) and neutron number density which we take to be greater than 10^{20} 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. The experimental data of observed elements are found to be in agreement with our calculated ones along the path. It produced heavy neutron-rich nuclei with A > 240. Unlike high densities, at low density of 10^{20} cm^{-3} and T_9 = 2.0 , the path contains all the elements as observed. Heavy transuranium elements (Z = 93-95) and their beta decay rates are obtained at densities $>10^{20}$ cm^{-3} and are found to be in agreement with the experimental values of Audi et al (2003). It is found that the superheavy elements' (Z > 105) formation along the r-process path is highly favored with the increase in temperature. We note that the element $_{98}Cf^{254}$ shown by the SN light curves is found in our classical astrophysical condition of T = 1.9 × 10^9 K and n_n = 10^{20} cm^{-3}. Also we note an element of mass 273 corresponding to atomic number 115, at temperature 3.0 × 10^9 K and neutron density 10^{20} cm^{-3}. It is found that the dynamical timescale of the final collapse is dominated by electron capture on nuclei and not on free protons.

Key words : R-process, nucleosysthesis, supernova, beta decay

CONTRIBUTORY TALK

The natures of the nuclear-transients

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ABSTRACT

Recent researches in the field of 'time domain astronomy' have revealed several new types of transients near the centers of the galaxies. Most of them are much brighter than canonical supernovae and exhibit very broad lightcurves with almost featureless spectra. Probably, they are either tidal disruptions of solar-mass stars (TDE) by the supermassive black holes, or superluminous supernovae (SLSNe) which are powered by shock-interaction or pair-instability processes or by a spin-down magnetars. Certainly, the physical process of TDEs and nuclear-SNe are completely different from each other. Recently several transient surveys (e.g., iPTF, ZTF, ATLAS, ASAS-SN) have discovered luminous nuclear-transients which exhibit photometric and spectroscopic properties that are some-extent similar to both TDEs and SLSNe. Here, I shall describe the general properties of various nuclear-transients and shall discuss about their possible progenitors. In this new era of the transient-survey, more peculiar transients will be detected. Coordination among different astronomical facilities is necessary to reveal the properties of such transients. Here, I will also discuss about the possible synergies between several Indian facilities and other observing facilities throughout the world in this regard.

CONTRIBUTORY TALK

Multi-wavelength and multi-messenger view of gamma-ray bursts

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ABSTRACT

The recent discovery of a nearly simultaneous electromagnetic and gravitational wave signal from a pair of merging neutron stars has opened up a new era of multi-messenger astronomy and brings gamma-ray bursts (GRBs) at the forefront. GRBs are intense flashes of highly energetic radiation, a single event having a brightness to briefly outshine all of the stars in all galaxies combined. How do they produce such enormous radiation, however, remains highly debated ever since their discovery. It is believed that a relativistic jet launched by a central engine radiates most of the energy via non thermal processes. However, we have shown that the spectrum of bright GRBs have additional thermal components namely, two blackbodies, and the solution indicates a geometric structure of the jet formed due to its interaction with the progenitor material. The recent multi-messenger observation enables us for the first time to examine the off-axis components which indeed shows an off-axis emission from a structured jet and/or a cocoon. I will discuss our understanding of a structured GRB jet in general and its signature in multi-wavelength data obtained by Fermi and Swift satellites. With the advanced detectors of LIGO and Virgo coming online during the end of the year, more such opportunities will arise. I will also discuss our preparation for follow-up observation with the Fermi satellite and ground based optical telescopes.

CONTRIBUTORY TALK

Variation of Ionospheric radiation may be one important precursor of earthquake

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ABSTRACT

Ionospheric radiation is the self luminance of upper atmosphere.This radiation is produced due to excitation of upper atmospheric ions,atoms and molecules.Ionospheric layer thickness fluctuates over epicentre of earthquake preparatory zone.This presents the consideration of ionospheric radiations as one of the important precursors of earthquake.

CONTRIBUTORY TALK

The outburst of H1743-322 in 2003 and its ramifications on later outbursts

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ABSTRACT

H 1743-322 exhibited a long duration outburst in 2003 after a long gap. The total energy released during this outburst was extremely high as compared to other tens of outbursts which followed. We extract accretion flow parameters for each observation from spectral properties of the decay phase and determine the mass of the black hole under TCAF paradigm. We compute the energy release during all the known outbursts since 2003 and find that on an average, the energy release in an outburst is proportional to the duration of the quiescent state just prior to it, with the exception of the 2004 outburst. A constant rate of supply of matter from the companion cannot explain the energy release in 2004 outburst. However, if the energy release of 2003 is incomplete and the leftover is released in 2004, then the companion's rate of matter supply can be constant since 1977 till date. This behaviour of viscosity at the accumulation radius Xp of matter as well as the Xp itself could be responsible for non-uniformity in outburst pattern.

CONTRIBUTORY TALK

Low frequency radio emission from extra-solar planets using TIFR GMRT Sky Survey

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ABSTRACT

Abstracts: All magnetized planets in the solar system emit radio emission through synchrotron and cyclotron maser radiations. Like Jupiter, most of the extra-solar giant planets are probably magnetized and they should also emit radio emission. We have searched for possible radio emission towards all known extra-solar planetary systems using the TIFR GMRT Sky Survey Alternative Data Release at 150 MHz. Radio emission is not detected from most of the extra-solar planets but it is detected from few star systems which harbor Jupiter size extra-solar planet. Strong magnetic field is required for sustained radio emission from planets and magnetic field in planet may be important for life to exist in the surface of the planet as it keeps away effects of energetic particles of cosmic rays, stellar winds and stellar flares. Here we will briefly summarize our findings.

CONTRIBUTORY TALK

Properties of high mass X-ray binary pulsars at different luminosities

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ABSTRACT

High Mass X-ray Binaries (HMXBs) are interesting objects that provide a wide range of observational probes to the nature of the two stellar components, accretion process, stellar wind and orbital parameters of the systems. Most of the transient HMXBs are found to Be/X-ray binaries, consisting of a neutron star in orbit around the companion Be star in a wide and highly eccentric orbit. Be/X-ray binary pulsars are generally quiescent in X-ray emission. The transient X-ray outbursts seen in these objects are known to be due to interaction between the neutron star and the circumstellar disk surrounding the Be star. The timing and broad-band X-ray spectral properties of a few Be/X-ray binary pulsars such as energy and luminosity dependent of pulse profiles, evolution of pulse period, nature of continuum spectrum, cyclotron resonance scattering features, emission geometry etc. during regular X-ray outbursts will be discussed.

CONTRIBUTORY TALK

A unified scenario of black hole X-ray binary states with jets

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ABSTRACT

We report a new method to explore if both the steady jets in the low-hard state (LHS) and transient jets in the transition state of black hole X-ray binaries (BHXBs) are primarily accretion-powered. In our theoretical magnetohydrodynamic calculations, we assume an advective accretion scenario to explain the accretion-jet processes in both the transition state and the LHS. Based on the estimates of the ratio of `mass flow rate into the jet' to `mass accretion rate' (˙Mj/˙M), we theoretically predict that the disc efficacy to launch transient jets is less than that for steady jets. We tentatively verify this theoretical finding using the ratio of radio−to−X-ray luminosities (L_R/L_X) for several BHXBs, where L_R and L_X are simultaneous measured, corresponding to each of steady jet and transient jet. Our study tentatively suggests that both steady and transient jets in BHXRBs could primarily be accretion powered, indicating a possible unified scenario of two BHXB states with jets. Our work may have a wider implication to understand the physics of accretion-jet mechanism in different types of accreting objects, such as radio loud active galactic nuclei.

CONTRIBUTORY TALK

Prospects of detecting fast radio bursts using Indian radio telescopes

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ABSTRACT

Fast Radio Bursts (FRBs) are short duration highly energetic dispersed radio pulses. We developed a generic formalism (Bera et al. 2016, MNRAS, 457, 2530) to estimate the FRB detection rate for any radio telescope with given parameters. By using this model, we estimated the FRB detection rate for two Indian radio telescope; the Ooty Wide Field Array (OWFA) (Bhattacharyya et al. 2017, J. Astrophys. Astr., 38, 17) and the upgraded Giant Metrewave Radio Telescope (uGMRT) (Bhattacharyya et al. 2018, J. Astrophys. Astr.) with three beam-forming modes. Here, I summarize these two works. We considered the energy spectrum of FRBs as a power law and the energy distribution of FRBs as a Dirac delta function and a Schechter luminosity function. We also considered two scattering models proposed by Bhat et al. (2004, Astrophys. J. Suppl. Series, 206, 1) and Macquart & Koay (2013, ApJ, 776, 125) for these works and I consider FRB pulse without scattering as a special case. It is found that the future prospects of detecting FRBs by using these two Indian radio telescopes is good. They are capable to detect a significant number of FRBs per day. According to the prediction, we can detect ∼10^5−10^8 , ∼10^3−10^6 and ∼10^5−10^7 FRBs per day by using OWFA, commensal systems of GMRT and uGMRT respectively. Even a non detection of the predicted events will be very useful in constraining FRB properties. In this talk, I will first discuss the background and the possible sciences with FRBs, and then I will present the future prospects of detecting FRBs using Indian radio telescopes.
Paper Link: https://link.springer.com/article/10.1007%2Fs12036-018-9542-5

CONTRIBUTORY TALK

The Formation of Star clusters in Planck Cold Clumps: the case of G108.37-01.06

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ABSTRACT

The Planck Galactic Cold Clumps (PGCCs) are the possible representations of the initial conditions and the very early stages of star formation. With an objective to understand better the star and star cluster formation, we probe the molecular cloud associated with PGCC G108.37-01.06 (hereafter, PG108.3), which can be traced in a velocity range - 57 to - 51 km/s. The IPHAS images reveal H-alpha emission at various locations around PG108.3, and optical spectroscopy of the bright sources in those zones of H-alpha emission discloses two massive ionizing sources with spectral type O8 - O9V and B1V. Using the radio continuum, we estimate ionizing gas parameters and find the dynamical ages of H II regions associated with the massive stars in the range 0.5 - 0.75 Myr. Based on the stellar surface density map constructed from the deep near-infrared CHFT observations, we find two prominent star clusters in PG108.3; of which, the cluster associated with H II region S148 is moderately massive (~ 240 M_sun). A careful inspection of JCMT 13CO(3-2) molecular data exhibits that the massive cluster is associated with a number of filamentary structures. Several embedded young stellar objects (YSOs) are also identified in the PG108.3 along the length and junction of filaments. We find the evidence of velocity gradient along the length of the filaments. Along with kinematics of the filaments and the distribution of ionized, molecular gas and YSOs, we suggest that the cluster formation is most likely due to the longitudinal collapse of the most massive filament in PG108.3.

CONTRIBUTORY TALK

Exploring the dissipative shocks in relativistic accretion flows around black holes

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ABSTRACT

In the present work, we study the effects on the accretion and wind flows due to the energy dissipation from the post-shock region (or from the Compton cloud). Results of our previous work (Das, Chakrabarti, Mondal, 2010) motivate us to explore the various features of the standing and dissipative shocks in the accretion and wind flows using exact relativistic equations. Thus, the results could significantly be different from that found in the previous works. As the radiative processes crucially depend on its hydro-dynamical features of the accretion disk, therefore, the results of our study would be extremely useful in providing a rigorous interpretation of EM-spectrum coming from the disk. Moreover, the oscillation of the shock location could be important to excite the quasi-periodic oscillations (QPOs) in the emitted radiation. Such an evolution of QPOs has been observed in several black hole candidates during their outbursts e.g. XTE J1550−564 and GRO J1655−40. Motivating from the current scenario, in the present study, we would like to focus on the following issues: (i) we study the properties of standing and dissipative shocks in the accretion flow using exact general relativistic framework and study the spin effect on the shocks (ii) then considering a wide range of the parameters namely energy, angular momentum of the flow and spin parameter of the black hole, we wish to investigate, the maximum percentage of total energy (iii) further, we would also like to find the effects on the mass outflow rates from the accreting matter.

CONTRIBUTORY TALK

Activity of Young Dwarfs with Planetary Systems: EPIC 211901114 and K2-33

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ABSTRACT

The results of an analysis of the activity of the young stars with planetary systems EPIC 211901114 and K2-33 based on observational data obtained over 70 days with the Kepler Space Telescope are presented. The rotation periods of EPIC 211901114 (8.56 ± 0.60^d) and K2-33 (6.29 ± 0.50^d) have been found. Maps of temperature inhomogeneities on the surfaces of EPIC 211901114 and K2-33 have been constructed. No relative displacements of the active regions on the stellar surface have been found for EPIC 211901114. The differential-rotation parameter has been estimated for K2-33, $\Delta\Omega = 0.0039?(0.0020\pm0.0012)$ rad/day. The fractional spotted area S on the surface of EPIC 211901114 reaches about 5% of its total visible surface. For K2-33, *S* is 3.8% of its total visible surface, on average. On the whole, the positions of EPIC 211901114 and K2-33 on *S*age, *S*rotation period, and *S*Rossby number diagrams match the general character of the dependence found earlier for M dwarfs. The flare activity of EPIC 211901114 and K2-33 has been studied, based on 32 flares of EPIC 211901114 and 7 flares of K2-33. The flare frequencies and amplitudes for EPIC 211901114 and K2-33 have been estimated, together with the time scales for their rise and decay. The flare energies have also been estimated, $1032.1-33.4$ and $1032.2-33.3$ erg for EPIC 211901114 and K2-33, respectively.

CONTRIBUTORY TALK

Nuclear astrophysics around compact object

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ABSTRACT

We know that supernovae are the most signifacant source of most of the heavy elements. However, there are a few other systems also in astrophysics where nucleosynthesis occurs depending on the higher temperature and/or density of the flow. One of the systems we have investigated is advective accretion flow happening onto a black hole (BH) from a companion star (binary accretion disk). In advective accretion disk, the proton temperature rises to 10^9 K or more. Some earlier work already showed that although density in an advective disk is very low, the very high temperature leads to the reaction rates to change the initial abundance significantly. We are exploring out which elements from the disk will survive in the outflow to enrich the interstellar medium by launching outflow from different radii with different ejection to accretion rates ratio using a simplistic spherically expanding adiabatic model. We have found that in the inner region of the disk all elements are disintegrated to neutrons and protons and if outflow is launched from there, no heavy element is produced. Nevertheless just before complete disintegration, even slightly away from inner region, the abundances of some typical heavy elements, which largely differ from initial abundances, are Sr^{84}~10^{-8}, Cr^{52}~10^{-4}, Ti^{46}~10^{-4} etc. If outflow is launched from this region, the final abundance becomes very much sensitive to the velocity of the outflow and to the abundance of disk at that region. We have found that if velocity of the ouflow is less than 10^{-4} c (c is the speed of light in vacuum) then whatever heavy elements produced in the disk are destroyed in the outflow. Nevertheless if the velocity is larger than 10^{-2} c, whatever in the disk is produced that remains almost same. With velocity in between, some heavy elements are produced also in the outflow. These results indicate that performing nucleosynthesis only in the disk may lead to wrong conclusion. Although quantitatively these changed abundances may affect negligibly in universal scale, but it can affect the observational analysis of a single binary accretion disk drastically. Using the final abundance we have been exploring the observational anomalies present in nature.

CONTRIBUTORY TALK

Mid-latitude and high latitude ionospheric disturbances associated with stratospheric warming events in the polar region

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ABSTRACT

We present several case studies of mid-latitude and high latitude D-region ionospheric disturbances during the northern hemispheric Sudden Stratospheric Warming (SSW) events, in different solar conditions, as sensed by sub-ionospheric VLF/LF radio signals. We have analysed VLF/LF radio signals from five transmitters (NAA, NRK, GQD, NPM, NLK) received at several places in Europe, USA and Japan during the events. Significant anomalies in nighttime and daytime VLF/LF signals have been found for all propagation paths associated with stratospheric temperature rise due to the SSW events that occurrred during solar quiet conditions. Simulation of VLF/LF diurnal variation are carried out using the well known Long Wave Propagating Capability (LWPC) code within the earth-ionosphere waveguide to quantify the ionospheric anomalies caused by the respective SSW events.

CONTRIBUTORY TALK

Comparative study of charged particle precipitation from the Van Allen radiation belts as observed by NOAA satellites during a land earthquake and an ocean/coastal earthquake

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ABSTRACT

Ionospheric-magnetospheric transition region and the time correlation of particle rate fluctuation and earthquake has been a subject of interest for various authors for the last few decades. Van Allen Radiation Belt is a zone of energetic charged particles originated from solar wind that are captured by Earth's magnetic field lines. There are several Low Earth Orbital (LEO) satellites to observe count rate of energetic particles in the Van Allen Radiation belt. In the present study, we used Medium Energy Proton and Electron Detector (MEPED) instrument data which is on-board the NOAA-15 satellite. Although significant particle bursts have been observed before some major earthquakes, the reliability of considering particle bursts as a promising earthquake precursor is still a debatable issue. This is because the particle bursts (PBs) are highly influenced by solar geomagnetic activity. There are various events that can result these PBs and thus correlating them with an impending earthquake is tough. In the present study, we searched for relatively large earthquakes with magnitudes greater than 6.5 that took place within a region of latitudinal extent from 0◦ to 40◦N and a longitudinal extent from 60◦E to 100◦E from 2012 till date. Within this window, a total of 38 earthquakes were detected. Next to eliminate any possibilities of contamination of hight solar activity with the earthquakes, we looked only for those earthquake days when the Ap index was below 16 and there were no events of sudden ionospheric disturbances. After filtering, we were left with only two earthquakes, one on January 3, 2016 and the other on December 6, 2016. The January earthquake was a land earthquake and the December earthquake was an ocean/coastal earthquake. The process of transport of seismogenic perturbations from the ground to the ionosphere depends largely on the properties of the propagating medium. A land and an ocean earthquake differs mainly in the ground properties such as the ground conductivity. Thus, it provided us with a great opportunity to investigate and compare the effects of these two types of earthquakes on the ionosphere-magnetosphere region. The data are downloaded from the NOAA website in netCDF format for the entire months of January and December. A dataset is created that contains information about time, latitude and longitude corresponding to the satellite passes, the electron count rates, geomagnetic B values, the L-shell parameters corresponding to the altitude of satellite passes and the pitch angles (α). To exclude the South Atlantic Anomaly (SAA) and to consider only the inner Van Allen Radiation Belt (VAB), the values of B and L are chosen to be greater than 22 μT and less than 2.2 respectively. Next to correlate the PBs with the earthquakes, we considered only those earthquakes for which the difference between the L-shells of the earthquake and the PBs satisfied the condition: $\Delta L <= 0.1$. The L-shell of the earthquake was taken as the L coordinate of the point at a certain altitude above the earthquake epicenter at which the seismogenic electromagnetic fields penetrate the ionosphere. As suggested by Molchanov, it was estimated to be 300 km which gave a L value of LEQ = 1.05. The results thus obtained showed PBs to be accumulated only around the earthquake day, being maximum on the day of the earthquake and with complete absence of such events on days away from the event day for the January 3 (land) earthquake. For the December 6 (ocean/coastal) earthquake, the effects were found to exist for a longer duration. This may be due to the fact that water has conductivity higher than land surface which lead to the transport of anomalies for a longer period for the ocean earthquake than the land earthquake.

CONTRIBUTORY TALK

Possibility of earthquake prediction by using VLF signals

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ABSTRACT

Very Low Frequency (VLF) is one of the bands of Radio waves having frequencies lying between 3-30 KHz. It propagates through the Earth-ionosphere wave-guide. Normally, patterns of VLF signal depend on regular solar flux variations. However, an extra source of ionization can change height of ionospheric layers and/or ion densities and these changes can perturb VLF signal amplitude. By measuring amplitude and phase of radio signals reflected from the ionosphere, it is possible to detect various kinds of energetic phenomena. Recently, scientists have noticed that prior to any seismic event a huge amount of energy is released which may create disturbances in the lower part of the ionosphere and hence the VLF signals which propagate through the ionosphere, may be perturbed. In this regard, we have analyzed the night time amplitude of the VLF signals and found that it anomalously fluctuated 3-4 days before seismic events. We have studied the behavior of the terminator times of the VLF signals and found that the `VLF day length' which is defined as difference of two terminator times of the VLF signals, increased anomalously few days before an earthquake. We also observed that the D-layer preparation time (DLPT) and D-layer disappearance time (DLDT) become anomalous a few days prior to the Earthquakes. By analyzing VLF signals for multiple propagation paths, we found evidences which indicate that it may also possible to predict epicenters of earthquakes in future by analyzing VLF signal propagation through multiple propagation paths.

CONTRIBUTORY TALK

ULIRGs: the possible progenitors of the powerful radio galaxies

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ABSTRACT

Ultraluminous infrared galaxies (ULIRGs) with enormous bolometric luminosity (L>10^12 Lsun) are mostly formed through merging of gas-rich spirals. Multiwavelength observations suggest that the power of ULIRGs are associated with starburst and AGN activities. Radio observations of ULIRGs are unaffected by the heavy dust obscuration, and have the potential to probe the central structures. We performed GMRT 1280 MHz radio continuum observations of three ULIRGs in order to resolve their core- jet/outflow radio structures and hence to examine their evolution into radio loud elliptical galaxies. Here we present our results of these ULIRGs which are merger remnants and possible progenitors of the powerful radio galaxies. These GMRT observations detected extended diffuse emission which represents the outflows in these systems . The radio spectrum of one ULIRG shows characteristic, similar to that of CSS/GPS like sources. This further represents an early stage of evolution of a classical double-lobed radio galaxy.

CONTRIBUTORY TALK

Analysis of the Ionospheric TEC over central India during low solar activity using ANN

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ABSTRACT

The equatorial ionosphere presents some of the highest Total Electron Content (TEC) values in the world coupled with observations of periodic structures. The Equatorial Ionization Anomaly (EIA) region, which comprises of almost two-third density of the global TEC, has crests at around 30 about the magnetic equator. Indore falls near to the northern anomaly crest and as a result sharp latitudinal gradient exists in and around this region. Analysis of TEC over this region thus becomes very necessary to characterize the equatorial ionosphere. TEC is strongly affected by solar activity and any enhancement in the ionospheric TEC due to the influence of solar activity may cause dramatic increase in the pseudo-range error. In the present work, TEC over Indore has been analyzed using the Artificial Neural Networks (ANNs), as huge amount of data handling is necessary for such time series analysis during the currently low activity phase of the Sun. Observations have been made when there had been disturbances due to varied geophysical conditions in the ionosphere using ANN.

CONTRIBUTORY TALK

Space weather effects on low and mid-latitudes

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ABSTRACT

We have shown the response of the mid-latitude D-region ionosphere to the super geomagnetic storm of 17 th March, 2015 using radio remote sensing technique. This geomagnetic storm, resulted from the coronal mass ejection on 15 th March, was the strongest storm of 24 th solar cycle. We analysed the VLF signal from four mid-latitude receiving stations. It is seen that, the storm enhanced the entire diurnal signal throughout the course of the storm. We have observed similar type of response in all the propagation paths. We estimated the enhancement of electron density in the D-region ionosphere and other parameters during this period with the help of a radio propagation model.

CONTRIBUTORY TALK

Modeling of simultaneous multiple path VLF observation of solar flare using zenith angle profile and LWPC

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ABSTRACT

Excess solar X-ray radiation during solar flares causes an enhancement of ionization in the ionospheric D-region and hence affects sub-ionospherically propagating Very Low Frequency (VLF) signal. It causes VLF signal amplitude perturbation (ΔA), phase perturbation (ΔP), amplitude time delay (Δt) and other associated characteristics. The nature of solar flare associated VLF perturbation events are strongly dependent on the characteristics of the signal propagation path, i.e. a given solar flare generally causes completely or partially different types of perturbative effects on VLF signals observed simultaneously across different propagation paths at different parts of the globe having different geophysical conditions. To study this phenomenon, we observe a C-class flare on 20th January 2016 simultaneously from a number of such paths, namely, VTX-Bharati, VTX-IERC, NWC-Bharati, NWC-Dunedin and NWC-Maitri. During these observations, the signal-to-noise ratio was significantly low at those observation stations. The amount of observed VLF amplitude perturbations at different paths are notably different. The diurnal solar flux profiles over the paths having different ground conductivity profiles are mainly responsible for it and so we model the zenith angle profile over the path. We have used the Long Wave Propagation Capability (LWPC) code to model the D-region including the zenith angle effects. The simulated VLF signals resemble with its observational counterpart. Finally, we performed a correlation analysis for a quantitative comparison.

CONTRIBUTORY TALK

Internal instabilities in magnetized jets

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ABSTRACT

Stability is a fundamental issue in the study of astrophysical jets, which are believed to be magnetized. We carry out an extensive linear stability analysis of magnetized cylindrical jets in a global framework. We focus on characterizing the small-scale, internal instabilities that are confined deep within the jet interior. Although large-scale jet integrity and coherence are desirable, some kind of internal instability is needed in order to explain several jet observations. We analyze the importance of the often overlooked thermal pressure gradient for triggering instabilities in a region of the jet dominated by a toroidal magnetic field and a weak vertical field. Such regions are likely to occur far from the jet source and boundaries, and are potential sites of magnetic energy dissipation that is essential to explain the particle acceleration and radiation observed from astrophysical jets. We find that the eigenfunctions of the most unstable modes are radially localized, which allows us to propose a generic instability criterion that transcends the complex nature of magnetic field inside jets. A stronger, radially varying vertical field, however, complicates this criterion by providing additional stabilization against the thermal pressure gradient. Nevertheless, we argue that the jet interiors generically should be subject to rapidly growing, small-scale instabilities, capable of producing current sheets that lead to dissipation. We also find instabilities that are sensitive to the background radial structure but have growth rates smaller than the localized modes.

CONTRIBUTORY TALK

Space Weather: Response of the Atmosphere to Solar Activity and Its Implications for LEO Satellites Aerodynamic Drag

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ABSTRACT

The atmosphere reflects the distinct signatures associated with long-term changes due to solar cycle, short-term changes related to solar phenomena such as solar flares, coronal mass ejections (CMEs), high solar wind streams (HSS) and corotating interaction regions (CIRs), as well as changes related to latitude variation. The orbital trajectory of low Earth orbiting satellites (LEOSs) are affected accordingly, as a direct consequence of the variability of atmospheric temperature (T) and density (ρ). Atmospheric perturbation increases drag on LEOSs leading to accelerated orbital decay. In this chapter, we present a compact review of atmospheric responses to solar activity and how they impact the orbital trajectory of low Earth orbiting (LEO) satellites. This review includes the recent progress we made in the studies related to space weather effects on the ionosphere and LEO satellites trajectory.

CONTRIBUTORY TALK

Spectro-polarimetric study of AstroSat-CZTI detected GRBs: GRB 160802A and GRB 171010A

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ABSTRACT

GRB 160802A and GRB 171010A are among the brightest gamma-ray bursts (GRBs) observed with Fermi Gamma-ray Burst Monitor (GBM) in the energy range of 10 - 1000 keV. Observations with AstroSat/CZT Imager (CZTI) also provides the polarisation which helps in constraining different prompt emission models using the novel joint spectra-polarimetric data. GRB 160802A: The photon index of the spectrum is hard, and in over 90 per cent cases, cross even the slow cooling limit ($\alpha = -2/3$) of an optically thin synchrotron shock model (SSM). The spectro-polarimetric data seems to be consistent with a sub-photospheric dissipation process occurring within a narrow jet with a sharp drop in emissivity beyond the jet edge, and viewed along its boundary. GRB 171010A: The energy spectra deviate from the typical Band function to show a low energy peak ~ 15 keV - which we interpret as a power-law with two breaks, with a synchrotron origin. Alternately, the prompt spectra can also be interpreted as Comptonized emission, or a blackbody combined with a Band function. Afterglow emission detected by Fermi-LAT is typical of an external shock model, and we constrain the initial Lorentz factor using the peak time of the emission. Swift-XRT measurements of the afterglow show an indication for a jet break, allowing us to constrain the jet opening angle to > 6 deg. We find that the burst has low, time-variable polarization, with hints that the emission may be polarized only at energies above the peak energy. We discuss all observations in the context of three models: a jet consisting of fragmented fireballs, emission from multiple shocks with random magnetic fields, or the Comptonization model.

SHORT TALKS

SHORT TALK

Comprehensive study of cosmic ray interaction with earth's atmosphere using Monte Carlo simulation

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ABSTRACT

Using Monte Carlo simulation we calculated primary and secondary particle flux at different height of the earth's atmosphere due to the interaction of primary cosmic rays in it from ground to balloon height (0-45 km) and at satellite height (400 km). We used Geant4 simulation toolkit for the full 3D description of the atmospheric and magnetospheric modeling surrounding earth. We study in detail the flux of different types of primary and secondary particles at mentioned heights in the earth atmosphere. We also compare the simulated results near the tropical latitude (geomagnetic latitude: 14.5 deg N) to the measured radiation flux using small balloon-borne low energy X-ray scintillator detector at this region.

SHORT TALK

Study of Quiescence Phase of Novae

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ABSTRACT

Studies of quiescence phase of novae are crucial to understand many aspects of the nova outburst and evolution; for example, the nature of the secondary and other components of the system; interaction among the binary components, effects of the outburst on the accretion disk, mass transfer rate, etc. In order to understand quiescence phase property of novae, I have observed a few quiescent novae using the 2m HCT. The spectra show prominent emission features of hydrogen, helium, iron and oxygen features of low ionization; few novae show absorption feature due the cool secondary component. The absence of higher ionization lines can be accounted for by the absorption and softening by re-radiation of all direct photons from the accretion disk. I have modeled the spectra using photoionizaton code CLOUDY. For modeling I have considered 3 components: the hot primary white dwarf, surrounded by a cylindrical accretion disk and the secondary companion. The modeled spectra were then matched with the observed ones using chi-square minimization technique. From the modeling of quiescence phase spectra, we determined the type of the secondary, estimated elemental abundances and other parameters related to the system.

SHORT TALK

Thermodynamics of the condensation of the early solar system grains

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ABSTRACT

The formation of the solar system initiated with the gravitational collapse of a presolar molecular cloud around 4.56 billion years ago. The initiation of the formation of the planetary system commenced with the condensation of the early solar system grains in the cooling solar nebula. We have developed a numerical code that deals with the thermodynamics of equilibrium condensation of the early solar system grains from the cooling primitive solar gas.This work is also relevant for the condensation of interstellar and circumstellar dust. The astronomical observations and studies of the interstellar dust grains separated from meteorites in laboratory have indicated the presence of dust grains with a wide range of chemical composition that in a manner reflect the elemental (and isotopic) traces of various stellar nucleosynthetic processes operating within the evolving stars. The condensation of these grains can occur in the circumstellar environments associated with the evolving stars with subsequent physico-chemical processing of these grains in the interstellar medium. The chemistry of all the species in the system assemblage is coupled and depends upon the temperature, pressure and relative abundances of the elements. It also gets affected by factors like oxygen fugacity and C/O ratio. The thermodynamics associated with the condensation of dust grains produces different condensation sequences in different astrophysical environments. In the present work, the condensation sequence, distribution of the major elements between solid and vapour, and condensation reactions have been computed. Detailed calculations have been performed and analysed at various pressures by adopting the recently revised solar abundances. Condensation of various pure phase solids and solid solutions was simulated in the fractionated solar gas. The physico-chemical conditions obtained through the model are found to be consistent with meteorites.

SHORT TALK

Disk-Jet Connection in Black Holes

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ABSTRACT

The coupling between accretion disk and jet is well established. Jet and accretion disk arise self-consistently from the two-component advective flow (TCAF) solution. Observationally, strong signatures of disk-jet connections have been seen for many black hole binaries. The nature and evolution of jets depend on accretion flows around black holes. Correlation between X-ray and radio fluxes are also visible, which indicate the coupling between accretion disk and jet. In this review, we have discussed about the development of the theoretical model to find the origin of the jets or outflows and the nature of the disk-jet coupling on the basis of the transonic flows around black holes. Then we discuss about the observational evidences of the disk-jet connections.

SHORT TALK

Direct Observational Evidence of Two Components in Accretion Flow onto a Black Hole

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ABSTRACT

Long-term RXTE/ASM X-ray data of several Galactic black holes (transient, persistent and class-variable) are analyzed. The results of this analysis show the existence of two components in accretion flow in both low-mass and high-mass X-ray binaries (LMXBs & HMXBs). Large disks with long viscous timescales in the accreting matter with high angular momentum are prevalent in LMXBs due to processes like Roche lobe overflow, while small disks with little viscous delays are observed in HMXBs primarily because of wind accretion. Because of two viscous time scales in the two components, there would be significant lag/delay between the times-of-arrival of these two components. A large Keplerian disk in LMXB should cause a larger time lag as compared to that in HMXB. To detect such a lag using the ASM data having limited energy resolution, we introduce an index (Θ), which is a proxy of the usual (i) hardness ratio (HR), (ii) photon index, (iii) spectral index (α), and (iv) Comptonization efficiency (CE) defined to be the ratio of the number of hard photons to the number of soft photons injected into the Compton cloud at each instant of time. Temporal variation of Θ also reveals spectral state transitions, despite showing this time lag directly. Classic method of cross-correlation between the two photon fluxes may not reveal the aforesaid lag. But when Θ, being susceptible to changes in the hard flux, is considered as a reference, a significant time lag is observed between the two fluxes in LMXBs. However, this lag is negligible in HMXBs. We therefore establish that there are indeed two components in the accretion onto a black hole. Furthermore, outbursts in several LMXBs are examined by our simple approach in order to give a generalized picture of the transient mechanism.

SHORT TALK

Can Toroidal Flux tubes collimate and accelerate the Jets/Outflow for a Blackhole

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ABSTRACT

Observations in the two spectral regions of the electromagnetic spectrum, in the domain of the hard X-rays on one hand, and in the domain of radio wavelengths, on the other hand, revealed the existence of relativistic jets known as microquasars or nano-quasars. It has been shown that the relativistic jets with significant matter content and kinematic luminosity are produced when the inner part of the disk is destroyed and evacuated. Clearly, the Magnetic field has to play a major role in origin, acceleration, and collimation of these relativistic jets. Due to predominantly rotating accretion flows close to the inner edge of a disk, magnetic fields advected through the flow would be toroidal. We study the trajectories of these toroidal flux tubes inside a time-dependent geometrically thick flow which undergoes a centrifugal force supported shock. These flux tubes are under the influence of drag force, tension, Coriolis force, and buoyancy force. We also study effects of these flux tubes on the dynamics of the inflow and the outflow specifically focussing on the outflow properties such as its collimation and the rate. It is seen that depending upon the cross-sectional radius of the flux tubes which control the drag force, these field lines may move towards the central object or oscillate vertically before eventually escaping out of the funnel wall (pressure zero surfaces) along the vertical direction. A comparison of results obtained with and without flux tubes clearly show the role these flux tubes play in collimation and acceleration of jets and outflows.

SHORT TALK

Photometric Monitoring of FUors and EXors

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ABSTRACT

Episodic accretion in low mass protostars still a poorly understood phenomenon though it represents an important stage in the evolutionary sequence of star formation. Based upon the strength in outbursts magnitudes, the duration of outbursts and accretion rates these sources are bimodally classified into EXors and FUors. We at ARIES have been carrying out photometric monitoring of these sources at optical V,R,I bands with the 1.3m DFOT to measure the transient changes in energy output of these sources and also to verify the existing bimodal classification of this class of sources. With the help of upcoming instruements TANSPEC and ADFOSC at 3.6m DOT we will be studying the variability and evolution of the spectral lines that will help in direct measurement of the evolution in accretion rate, outflows, winds and physical changes in environment.

SHORT TALK

Unusual Precursory Behaviour of VLF signal parameters Before Devastating Nepal Earthquake, 25th April, 2015

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ABSTRACT

We have been monitoring Very Low Frequency (VLF) signal of Indian Navy Transmitter VTX (17 KHz) from the Malda branch of Indian Centre for Space Physics (25.00° N, 88.15° E). Long before the great Earthquake of 25th April, 2015, we were receiving the usual terminators of sunrise and sunset, the signal showed unusual behaviour as far as various vital VLF parameters such as sun rise terminators (SRTs), sun set terminators (SST), D-layer preparation time (DLPT), D-layer destruction time (DLDT), from April 22nd, 2015 onward and it continued till the 27th of April, 2015. It is to be remembered that the devastating Earthquake (M=7.9 Richter scale) occurred on the 25th of April, 2015 with several aftershocks at the level of around 6.0 in the Richter scale in the next few days which followed. Surprisingly, the data became normal after this 25th of April, 2015. We suspect that this abnormal behaviour could be interpreted to be pre-cursors of the earthquake.

SHORT TALK

Study of Globular cluster escapees and exploring the common origin of globular clusters and Halo using n-capture elements

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ABSTRACT

Globular clusters (GC) are one of the oldest stellar population that might have formed before the re-inosation of the universe. Detailed understanding of the formation mechanism as part of galaxy formation is still an open problem. We have used chemical abundances of the Globular cluster stars to understand their origin. Detailed abundances of individual GC stars with are still a challenge with 8-10m telescopes. Here we present detailed abundances of stars that might have escaped from GCs using high-resolution spectroscopy with the Hanle Echelle Spectrograph (HESP). We also present heavy element abundance among GC stars using low-resolution SDSS data and compare them with Halo stars to understand the common origin.

SHORT TALK

Polarimetric study of comets 32P/Comas Sola and C/2015 V2 (Johnson) at low phase angles

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ABSTRACT

We present the polarimetric study of two comets 32P/Comas Sola and C/2015 V2 (Johnson) at phase angles 9.8° and 21.6° and heliocentric distances 2.29 AU and 2.66 AU respectively. The observations of these comets were carried out on 20th February, 2015 and 30th December, 2016 using the 1.04-m Sampurnanand telescope of ARIES, Nainital, India using R photometric band (λ= 630 nm, $\Delta\lambda$=120 nm). We have obtained the degree of polarization is -1.54% for 32P/Comas Sola and -1.5% for C/2015 V2 (Johnson) at photocenter which is consistent with the other observed comets at similar phase angles. Polarization is highly negative at circumnucleus halo as compared to different regions of coma. Polarization maps show both positive and negative polarization over the whole coma; it suggests the presence of smaller fluffy grains along with submicronic particles. Both in solar and anti-solar directions, radial dependence of intensity indicates the variation in physical properties of dust grains as well as the dust distribution throughout the coma. The intensity is higher in the tailward direction as compared to the sunward direction and a diffuse coma/tail-like structure is observed in the tailward direction which may due to the sublimation of ices and rocks by solar radiation pressure. Study of negative polarization at low phase angle reveals the composition feature of the cometary nucleus which keeps great importance in cometary science.

SHORT TALK

Radiative transfer modeling of some observable Interstellar species

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ABSTRACT

In case of Astrochemistry, the main application of radiative transfer is the estimation of molecular abundances from line spectra. Using LTE approximation is comparatively easier as it requires a minimal amount of parameters but this method is not suitable to use at lower densities because at lower densities Tex < Tkin. The non-LTE approximation is required in such cases but it often requires molecular collision data as an additional input which is not currently available for all molecules. Recently, Sil et al. (2017) and Gorai et al. (2017) proposed ethylamine, (1Z)-1-propanimine and propargyl alcohol as strong candidates for future astronomical detection. Here, we have performed both the LTE and non-LTE calculations for these species under various physical circumstances. In absence of measured or calculated collisional data files, we have used our estimated collisional rate (which was parametrized to have an educated estimation), for the non-LTE calculations. Calculated LTE and non-LTE transitions are compared under various physical condition.

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SHORT TALK

Accretion Properties of the Black Hole XTE J1118+480 with the TCAF Solution

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ABSTRACT

We have analyzed RXTE PCA and HEXTE data for 2000 outburst of black hole candidate (BHC) XTE J1118+480. The spectral analysis of the source has been done with two types of model: phenomenological power-law (PL) and physical two component advective flow (TCAF) fits file in XSPEC. Low and very low frequency quasi-periodic oscillations (QPOs), with a general trend of increasing frequency are observed during the outburst. Highly dominating contribution of a non-thermal power-law component as well as TCAF model fitted sub-Keplerian halo rate are observed during the entire period of the outburst. We have estimated X-ray fluxes coming from jet base using method based on constant normalization properties of the TCAF. Also, the probable mass of the source has been estimated from our spectral analysis with the TCAF model.

SHORT TALK

Archaeology of the Galaxy in the Era of Large Astrometric and Spectroscopic Surveys

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ABSTRACT

We have entered in the era of large astrometric and spectroscopic surveys. The newly released data from the European Space Agency's space observatory Gaia includes highly accurate astrometry and radial velocities of a large number of stars. On the other hand, spectroscopic surveys like GALAH provide the chemistry for several hundred thousand stars distributed throughout the stellar evolutionary phase. Here, we would like to present the impact of these surveys on the archeology of our galaxy, the Milky Way. We would also like to discuss the comparative studies of the results from these large surveys with the earlier studies based on limited samples and scrutinize how well those studies have performed in our understanding of the Galaxy formation and evolution. We further plan to speculate what these large surveys can uncover about the history of the Milky Way.

SHORT TALK

Galactic and extra-galactic transient radio sources

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ABSTRACT

Transient radio sources are mostly compact objects. Dynamic radio sky is not properly studied due to various reasons. There are different kind of compact source s which show highly variable radio emission from nano second to month time scale for different kind of physical reasons. We are systematically searching transient sources in Galactic plane. We have already discovered few transient sources, most of which have high spectral index and presence of circular polarization. We are also looking for transient sources in some well observed extra-galactic field. In this paper we will summarize different methods to search transient radio sources and will summarize our effort to search Galactic and extra-galactic transient sources. We will also summary different properties of newly discovered transient sources.

SHORT TALK

Polarization Studies and Distance Estimation of the High Latitude Cloud "Draco"

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ABSTRACT

Intermediate Velocity Clouds (IVCs) are the interstellar gas clouds having velocity less than 70 km/s. They are primarily composed of neutral hydrogen and are located at high latitude outside the Galactic plane. The Draco Cloud (l ~ 91^o , b~ 38^o) is the best studied high latitude IVCs and is appropriate to understand the origin of such IVCs. We studied the magnetic field geometry of this cloud, which will be useful to understand the dynamics and the evolution of the cloud, using optical polarization measurements with the Aries Imaging Polarimeter (AIMPOL) mounted on the 104 cm Sampurnanand Telescope at ARIES, Nainital. We also performed the high resolution spectroscopy with Hanle Eschelle Spectrograph (HESP) mounted at 2m Himalayan Chandra telescope for a large sample of sources distributed over whole cloud morphology to constrained the distance of the cloud with respect to other large-scale structures in the interstellar medium (ISM) that can be used to estimate the mass, size, density and pressure of such clouds. In this presentation I'll present results of our optical polarization study and the distance estimation for the IVC Draco.

SHORT TALK

Mapping of basaltic units and the mineralogical variations of Mare Tranquillitatis of Moon with temporal, spatial and topographical heterogeneity using Moon Mineralogy Mapper(M3) data of Chandrayaan-1

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ABSTRACT

Near side of the Moon is flooded with dark mare basalts formed by volcanic eruptions. The mineral composition of the Moon surfaces contains vital clues about its thermo-chemical evolution. In this work, we have mapped out mineralogy of the Mare Tranquillitatis basalt using Moon Mineralogy Mapper (M3) hyperspectral data onboard India's Chandrayaan-1 mission spacecraft. Mare Tranquillitatis is a non-mascon basin and is well known as first Apollo 11 landing site of the Moon, located at eastern near side of the Moon. It is a Pre-Nectarian age basin contains Imbrium age basalts. The area is widely mapped based on Fe and Ti content in the previous work. We have mapped the area based on mineralogical abundances of basalts. The lunar surface is bombarded by micrometeorites, the solar wind, and galactic cosmic rays which act to comminute particles to finer size, produce agglutinates (small impact glass-welded conglomerates of regolith particles), and coat particles with amorphous deposits containing submicroscopic metallic iron (SMFe). This process is known as Space weathering and its effect on Lunar surface is known as Maturity. Mare Tranquillitatis is comparatively older and is being continuously bombarded by solar wind, Galactic cosmic ray and micro meteorites from ages leads to more mature surface. To identify fresh material present in the area, we have decoupled the mature surface by applying 950/750 vs 750 band ratio for each of the basaltic unit mapped out in this study. Total of 22 units has been delineated and mapped on the basis of colour variations observed in the False Colour Composite (FCC) image generated using Integrated band depth (IBD) parameter Technique. The age of the mare basaltic units differs from 3.8 billion year to 3.55 billion year and the nomenclature (T1 to T30) of the units is done based on descending chronological order to study temporal variations in basaltic composition. The average reflectance spectra were calculated from each fresh crater (~1 km diameter) to identify mineralogical variations within and among the units. The spectral analysis has been carried out to investigate detailed mineralogical variation by deriving band centre, band strength, band area and band area ratio for each of the reflectance spectra. In the resulting analysis we are getting abundances of pyroxenes in area which are mostly high calcium pyroxene. These remote sensing-based results derived from the Hyperspectral data of the Moon was compared with the synthetic pyroxene data to investigate major mineralogical difference of lunar basaltic mineralogy. The IBD map units were overlaid on NASA's Lunar orbiter Laser altimeter topographic data sets. Eastern part is the highest elevated part while the western part is low lying part. In recent work, the eastern part is recognised as shield volcano of the moon. In our investigation, we are getting the largest basaltic units in eastern parts which strengthens the previous investigation that the area is the possible shield volcano which gives larger eruptive basaltic flow units compare to low lying western area gives number of small basaltic units. Chronologically the units of eastern part are younger compare western mare region. The investigation validates the previous interpretation that the eastern rise was formed by infrequent, high-volume episodes of lava which flooded areas beyond the rise itself.

SHORT TALK

Two-temperature dissipative accretion flow around black hole

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ABSTRACT

We study the properties of two-temperature accretion flow around a non-rotating black hole in the presence of various dissipative processes where a pseudo-Newtonian potential is adapted to mimic the effect of general relativity. The ions heat up the flow due to viscous heating, and a part of these energies is transferred to the electrons via Coulomb coupling. Finally, electrons radiated out these energies via different radiative processes like bremsstrahlung, synchrotron emission and Comptonisation of synchrotron photons. For the first time in literature, we obtain the two-temperature global shock induced accretion solutions in terms of dissipation parameters, namely, viscosity (α) and accretion rate ($\dot{m}$). We study all the dynamical properties of shock-induced global accretion solution and identify the parameter space of such solutions for several dynamic possibilities. Since the post-shock region is hotter due to the effect of shock compression, it naturally emits hard X-rays, and therefore, the two-temperature shocked accretion solution has the potential to explain the spectral properties of the black hole sources.

SHORT TALK

Relativistic Magnetohydrodynamics with Relativistic Equation of State

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ABSTRACT

We study relativistic magnetized outflows using relativistic equation of state having variable adiabatic index and composition parameter. In this study we ignored the gravity and study the outflow from sub-Alfvenic to super-fast domain. We are interested in finding the location of the fast point. After this point, magnetic field collimates the flow and may form a collimation-shock due to magnetic field pinching/squeezing. Such fast collimated outflows can be considered as astrophysical jets. We find that the composition of flow does not affect the collimation of outflows/jets but it mainly affects the temperature of the flow.

SHORT TALK

Relativistic acoustic geometry in general relativistic accretion disc around Kerr black holes

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ABSTRACT

In our work, we linear perturb the mass accretion rate in a general relativistic accretion disc around a Kerr black hole and show that it gives rise to a curved acoustic spacetime metric. We study the conformally invariant features of the acoustic spacetime for accretion flow with and without shock formation. We show that the acoustic horizon and the transonic surface of the accretion flow coincide. We study the causal structure of the acoustic spacetime by numerically integrating the stationary accretion flow equations and provide an expression for the acoustic surface gravity, which is a measure of the analogue Hawking temperature, in terms of the background metric elements and the stationary accretion variable. We also study the linear stability of the stationary accretion solutions.

SHORT TALK

Study of light scattering properties of porous dust particles

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ABSTRACT

The knowledge of astrophysical bodies comes from the study of sunlight scattered by dust particles. The study of scattered sunlight gives information about the physical properties of cometary dust such as size distribution, composition, shape and porosity of the particles. The scattered radiation that we receive from the dusty coma of comets is mainly characterized in terms of polarization, color and thermal re-emission. In order to study the effect of porosity, a study has been undertaken to compute the optical properties of the porous dust particles using Discrete Dipole Approximation (DDA) code. The variation of scattering efficiency factor as a function of size parameter has also been studied to understand the influence of particle size on scattering matrix elements in random orientation. The results are then compared with Mie results where effective refractive index for each porosity are calculated using Bruggemann mixing rule. Also, the thermal re-emission from cometary dust in terms of composition and size distribution has been discussed.

SHORT TALK

Soft X-ray excess in Mrk-766

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ABSTRACT

In high energy astrophysics Active Galactic Nuclei (AGNs) come under the most complicated objects. AGNs are supposed to be super massive black holes (SMBHs) onto which surrounding material is accreting with sufficient rate. These are classified in different objects e.g. quasars, blazars, radio galaxies and seyfert galaxies. According to Unified model these objects are further divided depending upon the viewing angle. To understand the system completely it is necessary to know what physical processes are going on in the vicinity of SMBH. In this work a detailed spectral and timing studies have been done for narrow line Seyfert 1 (NLS1) galaxy Mrk 766, a subclass of AGNs, in X-ray region of electromagnetic spectrum. For the first time, simultaneous observations at two epochs of three satellites XMM-Newton, Nustar and Swift were used in combination. In the energy spectra of both the epochs the observed features, apart from continuum are soft X-ray excess below 1 keV, Fe Kα line near 6 keV and a hump near 20 keV. To explain these features three models; the blurred reflection model, partial covering model and Comptonization model were applied in 0.3 to 60 keV energy range. From timing studies, we find that the invariability of Fe Kα and hard X-ray excess do not favor reflection model while unvaring photon index does not support cool Comptonization for the origin of soft X-ray excess. On the other hand, the correlation was found between soft excess temperature and power-law flux that indicates thermal X-ray emission reprocessing as the origin of the soft excess.

SHORT TALK

Distance to L 1172/1174 based on Gaia parallax measurements

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ABSTRACT

L 1172/1174 is a molecular cloud system located in the constellation of Cepheus and showing current star forming activities. A 10 Msun Herbig Be star, HD 200775, is forming in the cavity of L1174 illuminating a reflection nebula, NGC 7023. A number of low mass young stellar objects are also forming in the vicinity of HD 200775. The high extinction part of L1174 extents further to the south and connects to L1172 as a single filamentary lane making its appearance as a head-tail morphology. Several efforts have been made to estimate distance to this cloud system employing different data and techniques but a large scatter is found in the literature (~250-450 pc). Therefore, based on our polarization and the Gaia parallax measurements of stars projected on the whole cloud, we estimated its distance. We also used two additional techniques to determine the distance to the cloud system. The results obtained from all the three methods are found to be consistent. Here we will discuss the techniques used and the results obtained from our study in detail.

SHORT TALK

Multiwavelength analysis and modelling of successive flux rope eruption from solar active region NOAA 12673 and associated X-class flares on 2017 September 6

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ABSTRACT

We present a multi-wavelength analysis of two X-class solar eruptive flares of classes X2.2 and X9.3 that occurred in the sigmoidal active region NOAA 12673 on 2017 September 6, by combining observations of Atmospheric Imaging Assembly and Helioseismic Magnetic Imager instruments on board the Solar Dynamics Observatory. On the day of reported activity, the photospheric structure of the active region displayed a very complex network of δ-sunspots that gave rise to formation of a coronal sigmoid observed in the hot EUV channels. Both the X-class flares initiated from the core of the sigmoid sequentially within an interval of \sim3 hours and progressed as a single "sigmoid-to-arcade" event. Differential emission measure analysis reveals strong heating of plasma at the core of the active region right from the pre-flare phase which further intensified and spatially expanded during each event. The identification of a pre-existing magnetic null by non-force-free-field modeling of the coronal magnetic fields at the location of early flare brightenings and remote faint ribbon-like structures during the pre-flare phase, which were magnetically connected with the core region, provide support for the breakout model of solar eruption. The magnetic extrapolations also reveal flux rope structures prior to both flares which are subsequently supported by the observations of the eruption of hot EUV channels. The second X-class flare diverged from the standard flare scenario in the evolution of two sets of flare ribbons, that are spatially well separated, providing firm evidence of magnetic reconnections at two coronal heights.

SHORT TALK

Study of initiation, Interplanetary Consequence and Geo-effectiveness of CME Associated

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ABSTRACT

In this paper we present the multi-wavelength analysis of a major X-class flare (X 9.3) that occurred in active region NOAA 12673 on September 06, 2017, during 11:53 UT to 12:10 UT. This event also produced a fast Coronal Mass Ejection. Active region NOAA 12673 (or simply 2673) emerged at S09W30 on September 06, 2017, and grew rapidly to a large active region. Its maximum area was 1060 millionth of the solar hemisphere on 09 September. The group disappeared over the west limb of the Sun (S09W83) on 10 September. It was a fast emerging flux region. The group showed βγδ magnetic configuration. We identified their earliest signatures of eruption in AIA 94 - images with activation and successive rapid expansion of hot channel- like structures from low coronal heights. On other hand this flare event gives rise the intense Dst at 1 AU (-142nT). The observation from the source active region to the corona, interplanetary medium and in-situ measurement at 1 AU, we identify complex processes of CME-CME interaction that have significantly contributed to make this event such geo-effective.

SHORT TALK

Ozone on Callisto

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ABSTRACT

Ozone (O_3), regarded as biomarker, has been observed on the icy satellites Ganymede [1], Dione and Rhea [2]. Presence of O_3 on the icy surfaces of Ganymede, Rhea and Dione are due to the energetic processing of oxygen bearing molecules. Laboratory experiments had shown efficient synthesis of O_3 in oxygen bearing molecules such as CO, CO_2, SO_2, NO, NO_2. Most of the laboratory experiments used InfraRed (IR) spectroscopy to detect O_3 synthesis [3]. However, unambiguous O_3 detection in planetary objects using IR signatures is quite difficult due the presence of silicates. Therefore, the Hartley band of O_3, 220 - 310 nm, was used to find O_3 presence on icy surfaces [4].

Apart from the three satellites of the outer Solar System there may be other satellites that might harbour O_3 . UltraViolet (UV) spectrum of Callisto recorded by the Hubble Space Telescope was reported to show spectral signatures of SO_2 [5]. Based on this observation, the irradiation experiments simulating SO_2 ices on Callisto revealed the coexistence of SO_2 and O_3 . The spectral signatures in the UV were found to extend from 220 - 310 nm with a broad peak 255 - 285 nm, clear indication of O_3 embedded in the SO_2 ice matrix. In this meeting, we will present the detailed analysis that resulted in the finding of O_3 on Callisto.

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SHORT TALK

Multiwavelength study of an HII region

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ABSTRACT

The studies of embedded HII region under the influence of immense ultraviolet (UV) radiation and stellar winds from the massive stars are crucial for the comprehension of the evolution of the HII regions and the formation of the next generation of stars. One of the notable feedback effects of massive stars is the triggering of star formation of new generations, either by sweeping the neighboring molecular gas into a dense shell which subsequently fragments into pre-stellar cores or by compressing pre-existing dense clumps. An HII region which contains several young and massive infrared (IR) sources along with central O-type high mass stars, is ideally suited to study the impact of massive stars on the formation of high- and low-mass stars in its surroundings.
In the present poster we will show multi-wavelength study of one of the HII region from the Sharpless catalog, which we have done to understand the star formation process in the region. We have performed deep and wide field photometry of the region in optical and (NIR) wavelength which we have observed using the 1.3 m Devasthal telescope and 2.0 m HCT, respectively. These observations along with archival data from 2MASS, Spitzer and WISE had been used to identify young stellar objects (YSOs) on the basis of their IR excess emission. We have determined reddening and distance of this region using (U-B)/(B-V) TCD and V/(V-I_c) CMD respectively. We have also done optical spectroscopy of probable ionizing source of the region using HCT and determined spectral type of these sources. Along with the completeness of photometric data in this region, Mass function (MF) and K-band luminosity function (KLF) has also been determined.

SHORT TALK

Multi-wavelength study of GRO J1719-24 during outburst of December 2016

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ABSTRACT

Low mass X-ray binaries provide a unique opportunity to study the properties of the accretion disk especially when the companion is faint and its contribution to the total flux is negligible. One such transient XRB GRO J1719-24 went into outburst for the second time in December 2016 following the discovery in 1993 wherein a BHC with mass in excess of ~5 M_sun was predicted. It was observed by AstroSat, Swift, and NuSTAR as a ToO source in X-rays and UV. It was also observed in optical and NIR bands from the Mt Abu Infrared Observatory, with V and J band magnitudes reaching ~16.8 and ~14.2 respectively. Using all the available data, a multi-wavelength analysis is attempted which promises to provide better constraints on accretion rate, black hole mass, disk outer radius, etc. and help in understanding various energetic processes. We explore the various processes, viz. disk emission, coronal reflection, jet synchrotron emission, etc by modeling the same and fitting the broad-band spectrum spanning NIR to hard X-ray. I will discuss the preliminary results of our analysis.

SHORT TALK

Astrophysical tests of gravitational theories

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ABSTRACT

Although General Relativity (GR) has passed robust tests in the Solar System and stellar - mass scale (binary pulsars and binary black holes), tests in subgalactic, galactic and cosmological scales have only recently come up. We have weak constraints on alternatives in regions previously unexplored such as in the neighbourhood of the super - massive black holes. After reviewing the cosmological an astrophysical tests of GR, the author will highlight the results of latest theoretical and observational investigations on the subtle deviation of GR from its metrical extensions - the Brans-Dicke theory and f(R) gravity in the prediction of periastron advance of the S- stars near the galactic centre (GC) black hole. Stars resolvable by astrometric accuracy of the VLT and upcoming Extremely Large Telescopes (ELTs) are potential probes for understanding how gravity works near the black hole. Theoretical calculations are now available to test whether alternative theories of gravity can be distinguished from GR by astrometric observations of the upcoming optical - IR observations of the ELTs. Whereas GR has passed the tests in the observations of gravitational redshift of light from the S-stars and recent measurements of the orbit of the star S0 - 2, performed by Keck and VLT we have not yet strongly ruled out the alternatives. It is expected that we will have better cosmology with a modification of the law of gravity to resolve the puzzle of the dark universe. Scalar-tensor gravity and curvature modifications are two such extensively studied arrangements. In this talk, prospects of new formalisms of gravity near the GC black hole will be discussed. Detectability of such deviation through astrometric capability of the upcoming optical - IR observations of the ELTs will also be examined.

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SHORT TALK

Two-temperature advective transonic accretion flows around black holes

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ABSTRACT

Electrons are the ones which radiate via processes like synchrotron, bremsstrahlung and inverse-Compton scattering, therefore the electron gas and proton gas are supposed to settle down into two different temperatures. Not much work has been done in two-temperature accretion flows around black holes. So we addressed this problem in greater details in the pure general relativistic regime. The problem with two-temperature flow is that, there is one more variable than the number of equations. Assuming axis-symmetry and hydrostatic equilibrium in the vertical direction, we have four equations of motion, while there are five flow variables: v_r, v_Φ, electron temperature (T_e), proton temperature (T_p) and density. Solving the equations of motion for a given set of constants of motion, we find that no unique solution exists unlike in the case of one-temperature flows or in other words the solutions are degenerate. So, for different combinations of the flow variables we get different kinds of transonic solutions with drastically different topologies, for the same set of constants of motion. We removed the degeneracy with the help of second law of thermodynamics. We show that only one of the solutions among all possible, has the maximum entropy and therefore is the correct solution, eliminating the rest of the degenerate solutions. As far as we know no methodology of obtaining unique transonic two-temperature solutions has been reported so far in literature. This is the first time we have attempted towards obtaining the general picture of the physical solutions in the two-temperature regime.

SHORT TALK

Study of interplanetary and Solar wind features with Geomagnetic storms during ascending phase of solar cycle 23 and 24 at 1 AU

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ABSTRACT

In this presented work we examine the occurrence rates and properties of Interplanetary Coronal Mass Ejections (ICMEs) and solar wind features during the rising phase of solar cycle 23 (January 1996 - December 2000) and 24 (January 2008 - December 2012) using observations from the OMNI data base. In particular, we give a detailed list of such events. In this given list, based on in situ observations, we consist a subsets of Interplanetary shock, ICMEs and magnetic clouds corresponding with intense/ super-intense geomagnetic storms. Here we select total 76 geomagnetic storm events (55 events for solar cycle 23 and 21 events for solar cycle 24) which have dst ≤ -75 nT. We demonstrated in this paper that there were differences in the general ICME properties between the SC 24 rising phase and same phase of the solar cycle 23. It is concluded that the four main interplanetary structures (Interplanetary shock, ICMEs and magnetic clouds, southward component of IP magnetic field) that caused intense geomagnetic storms during solar cycle 23 and 24. Geomagnetic activity levels during the rise phase (first 5 years) of solar cycle 24 were lower than during any comparable period of solar cycle 23. ICME activity were reduced in the rise of cycle 24 compared to cycle 23.

SHORT TALK

Thermal Anomalies: As Lithospheric - Tropospheric interaction and precursory effect of large Earthquake

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ABSTRACT

We present the effect of air ionization during and prior to large earthquakes. During and prior to large earthquakes, radon discharge from different cracks and faults is the primary source of air ionization. The newly formed ions coagulates with water molecules and drastic change in air temperature and relative humidity is observed. These changes extend up to the increment of surface latent heat flux also and can be observed though various remote sensing satellite as well as in many ground based measurements of surface air heat and other thermal parameters. We are presenting the change in air temperature, relative humidity and surface latent heat flux parameters as a precursory phenomenon of Nepal 2016 and Honsu 2011 Earthquakes. As the thermal excitation profile is different for land and sea, we compare the variation of pre-seismic thermal parameters for Nepal (land) and Honsu (near sea) earthquakes.

SHORT TALK

Designing an effectual template placement algorithm for searches of gravitational wave from compact binary coalescences

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ABSTRACT

The detection of gravitational waves from compact binary systems of neutron stars and black holes are the primary goal of the gravitational-wave observatories Advanced LIGO and Advanced Virgo. Accurate theoretical models of expected signals from compact binary systems have been used to filter the detector data using the matched filtering technique. An efficient grid over the parameter space at a fixed minimal match has a direct impact on improving the computational efficiency of these searches. Here, we present a new hybrid geometric-random template placement algorithm over three-dimensional parameter spaces having moderately varying curvature. Also, we introduce several new optimizations which further embellish the underlying algorithm. These include the use of a variable lower-cutoff frequency and imposing a lower bound on the template duration which improves the ability to observe the high-mass binary black hole systems up to several hundred solar masses. The algorithm is also optimized by capitalizing on a degree of freedom where the underlying geometrical lattice of template points can be suitably oriented in the target search space. We construct an explicit hybrid template bank with input parameters identical to the uber-bank used in the recently-concluded searches in LIGO's O2 data. We exhibit a reduction of 50,000 templates over the stochastic template bank at a near-identical coverage. We also outline a computationally efficient, semi-numerical calculation of the parameter space metric over the post-Newtonian chirp time coordinate systems. This technique is applicable, in general, to calculate the metric for any waveform family with nonzero spins that are (anti-)aligned with the orbital angular momentum. The hybrid banks can be generated much faster in comparison to the stochastic banks. The resulting hybrid template banks are ready to be used in future searches of advanced LIGO.

SHORT TALK

Comparison of Ionospheric Vertical Total Electron Content during high solar active year and low solar active year for Indian region based on IGS station GPS observables

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ABSTRACT

The Total Electron Content (TEC) is the ionospheric parameter that has the main effect on radio wave propagation. The dispersive nature of the ionosphere makes it possible to measure its TEC. Thus Global Positioning System (GPS), which uses dual-frequency radio signals, is an ideal system to measure TEC. The International GNSS Service (IGS) have been continuously contributing to reliable IGS combined vertical total electron content (VTEC) maps in both rapid and final schedules. We figure out the percentage change of TEC during low and high solar activity over Indian landmass. The Total Electron Content (TEC) is computed from GPS from Bangalore (13.02^0N, 77.57^0E) IGS stations for the low solar active year 2007-2009 and the high solar active year for the period of 2014-2017. We compute both the slant TEC and vertical TEC for these two stations and compute the percentage change in TEC variation. We also compare our findings with existing IRI models.

SHORT TALK

Alignment of the jet with black hole spin: a hint from the TDE Swift J1644+57

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ABSTRACT

We present the effect of air ionization during and prior to large earthquakes. During and prior to large earthquakes, radon discharge from different cracks and faults is the primary source of air ionization. The newly formed ions coagulates with water molecules and drastic change in air temperature and relative humidity is observed. These changes extend up to the increment of surface latent heat flux also and can be observed though various remote sensing satellite as well as in many ground based measurements of surface air heat and other thermal parameters. We are presenting the change in air temperature, relative humidity and surface latent heat flux parameters as a precursory phenomenon of Nepal 2016 and Honsu 2011 Earthquakes. As the thermal excitation profile is different for land and sea, we compare the variation of pre-seismic thermal parameters for Nepal (land) and Honsu (near sea) earthquakes.

SHORT TALK

Complex Organic Molecules in Hot molecular core

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ABSTRACT

Chemistry in high mass star forming regions (HMSFRs) is very rich and it has a meaningful impact on the evolution of the Interstellar medium (ISM). The observation of high mass star forming region reveals the presence of various complex organic molecules (COMs) in it. We have analyzed the ALMA cycle 3 data with C40-4 configuration of a hot molecular core. In this source, we have observed several complex organic molecules such as methanol (CH_3OH) glycolaldehyde (CH_2OHCHO), ethylene glycol (CH_2OH) 2, ethanol (C_2H_5OH), ethyl cyanide (C_2H_5 CN) acetone (CH_3COCH_3), and dimethyl ether (CH_3OCH_3). Local thermodynamic equilibrium (LTE) model have been employed to estimate the best fit column density of the observed COMs. Rotational diagram analysis has been carried out for those molecular species we detect many lines. The rotational diagram analysis suggests that the temperature of this hot molecular core greater than 150 K. The column density of molecular hydrogen is estimated using dust continuum emission data obtained from the observations.

SHORT TALK

Phase-dependent Photometric and Spectroscopic Characterisation of the MASTER-Net Optical Transient J183012.04+093342.6 : An OH/IR star

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ABSTRACT

We present here optical/near-infrared photometric and spectroscopic observations of the MASTER-Net optical transient J183012.04+093342.6 - an Arecibo OH/IR star. We have performed long-term optical/near-infrared photometric and spectroscopic observations to characterize the object using NICMOS-3 on the 1.2 m IR Telescope at Mt Abu, and HFOSC and TIRSPEC instruments on the 2 m Himalayan Chandra Telescope (HCT) at Hanle. The variability period of 580±30 days are determined from the light curves. The amplitude of the observed light curves range from $\Delta R \sim 3.5$ mag to $\Delta I \sim 3.5$ mag. We estimate distance and luminosity from standard Period-Luminosity relation, and construct the spectral energy distribution (SEDs) from photometric and IRAS-LRS data that provides effective temperature and dust mass-loss rate. We study the time-dependent variability of atomic and molecular features (e.g., TiO, Na I, Ca I, CO, H2O) commonly observed in optical/near-infrared spectra of OH/IR stars. Such time-dependent spectroscopic observations, however very rare, provides important informations about the stellar interior and dynamical atmosphere of those pulsating objects.

SHORT TALK

Radiation Induced Chemistry on Icy Satellite Surfaces Embedded in Magnetospheric Plasma Environments - A New Experimental Facility at PRL

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ABSTRACT

Icy satellites, such as Io, Europa, Ganymede, Callisto and Rhea etc., are bombarded by energetic particles in the surrounding plasma produced in the Jovian and Saturnian magnetospheres. Plasma-satellite interactions via particles, with energies ranging from keV to MeV, process the icy surfaces of the satellites with varied chemical compositions. Indeed, such interactions also lead to chemical exchange between the satellites whilst altering the chemical composition of the surface ices. Recent findings from the space and ground based observations on the signatures of several new molecules reveal complex chemistry that is yet least understood under the conditions that are unique to the icy satellites of our outer solar system. By performing laboratory based experiments, that simulate conditions prevailing in the icy satellites, chemical pathways that underpin formation of complex molecules on icy satellites can be revealed. The new experimental setup (Figure 1) operated at Ultra High Vacuum (UHV) condition is equipped with a 30 keV electron gun and a ZnSe substrate at ~ 10 K, to form molecular ices, in order to simulate plasma-icy surface interaction. Non-equilibrium reactions initiated by keV particle interactions are probed in the mid-infrared (11000 ? 200 cm -1) region using a Fourier Transform InfraRed (FTIR) spectrometer. In this poster preliminary results and their implications to icy satellite surface chemistry will be discussed.

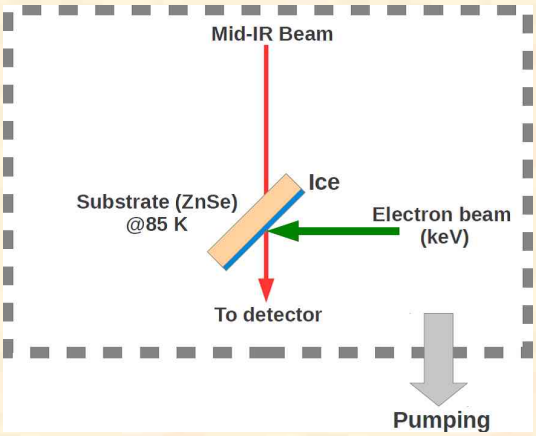

Figure 1: Schematic of the experimental setup.

SHORT TALK

Topside ionospheric effects of the annular solar eclipse of 15th January 2010 as observed by DEMETER satellite

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ABSTRACT

We studied effects of the annular solar eclipse of 15th January 2010 on the topside ionosphere using the DEMETER satellite data. Measurements of the electron-ion density and electron temperature by the ISL (Instrument Sonde de Langmuir) and IAP (Instrument Analyseur de Plasma) instruments on board the DEMETER satellite during the eclipse time over the low latitude (~40) Indian ocean area are presented. We found decrease in electron density by about 25% and decrease in ion density by about 33% from the reference orbits at the altitude of the satellite (~660 km). Electron and ion temperatures were also found to have decreased by 200-300 K at the same altitude. Instead of simple decrease as in ion density, electron temperature showed a complex wave-like oscillation as solar eclipse progressed. Electron density decreased to a minimum value before the maximum obscuration and again started to increase before passing through another minimum at the time of maximum obscuration. Both the minima are located at the ~10 degree geomagnetic latitude. Variations of electron and ion densities were found to follow the average solar illumination experienced by the satellite and its conjugate points at satellite altitude on the magnetic field lines connecting these two points, while the electron temperature showed no such correlation.

SHORT TALK

Physical conditions of HII regions in Supebubble N44 in the LMC

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ABSTRACT

The superbubble N44 region is an active high mass star forming region in the the Large Magellanic cloud galaxy (LMC). The LMC (metallicity Z=0.5 solar) at a distance of 50 kpc with a half solar metallicity is an appropriate site to study the physical properties of high-mass star forming regions in a metal-poor environment . About 35 massive hot O type stars have been found in associated with the superbubble N44.We aim to carry out a detailed study of the HII regions in N44 by using optical and infrared data. We use Hα , [SII] and [OIII] emission maps which are obtained as part of Magellanic Cloud Photometric Survey (MCPS). We also use the Spitzer photometric and spectroscopic data obtained as part of Surveying the Agents of Galaxy Evolution (SAGE). Spitzer photometric and spectroscopic data are used to trace the properties of dust feature. We present our preliminary study of electron density, ionizing photon flux, Str?mgren radii, intensity of interstellar radiation field and the morphology of N44. Our study shows that the electron density of N44 varies from 7 - 40 cm^{-3} . The Lymann continuum photon luminosity of each ionizing star in the region is found to be $0.28X10^{49}$ photons/s to $3.99X10^{49}$ photons/s. We use [SII]/Hα and [OIII]/Hα ratios to distinguish shock induced and photoionized gas in N44.

SHORT TALK

Numerical modeling of seasonal and diurnal variations of lower ionospheric reflection parameters based on IRI model

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ABSTRACT

Very Low Frequency (VLF) radio wave travels through the earth ionosphere waveguide and modulates according to the electron/ion density profile of the ionosphere. The Wait's two component model deals with ionospheric reflection parameters known as effective reflection height (h') and steepness parameter (β). Theoretically, β is the positive slope electron density profile curve as a function of height. We try to compute a range of β values from the electron density profile of ionosphere. International Reference Ionospheric (IRI) model 2012 is an empirical standard model of the ionosphere, based on all available data sources. We compute the ionospheric reflection parameters (β and h') from the true electron density profile as taken from IRI model for the year 2016 from altitude range 65 km - 85 Km at IERCOO/ICSP, Sitapur (22.5). We try to compute all sets of possible β and h' for NWC-IERCOO path for different time of the day and for the entire 2016. By using β and h' and LWPC code, a diurnal and seasonal trend of VLF signal amplitude profile is computed.

SHORT TALK

Search for variable stars in young open clusters

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ABSTRACT

Most of the stars show variability in their light curve at least in some phases of their lifetime. Several mechanisms are known to induce these variability, for example irregular distribution of cool spots on stellar photosphere, variable hot spots, obscuration from dust instability in disk, change in accretion rate, pulsations, etc. The evolution of disks and the accretion rates may play a prominent role in the non-periodic variability whereas due to the presence of cool and hot spots on the photosphere, rotation of the stars may produce periodic/quasi-periodic changes in their light curve. The period of the light curve of a rotating stars is direct indicator of it's rotation period and hence related to angular momentum. In this work, we are studying the variability properties of stars in a sample of young star clusters in our Galaxy. With the help of Hertzsprung-Russell diagram of these clusters, we can constrain the physical parameters such as age and mass of pre-main sequence/main sequence variable stars and it is easy to check the correlation of different physical parameters (period/amplitude, accretion rate etc.) with age and mass. Our study suggests that in a typical young cluster we get as many as 30-40 periodic variables and 20-30 non periodic variables. Period of periodic variables ranges from few hours to 15-20 days while amplitude ranges from 0.05 mag to 2 mag. The amplitude of variables increases with IR excess where as rotation speed seems to slow down with IR excess. We will show the results of few clusters obtained in our study.

SHORT TALK

Magnetized disc-outflow symbiotic model around black holes and its implication to Ultra-luminous X-ray sources

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ABSTRACT

In the absence of adequate molecular viscosity, the turbulent viscosity is generally assumed to play the key role to transport matter in accretion discs. The most self-consistent approach, in order to understand vertical transport of matter through the large-scale magnetic effects, is considered here. Such an attempt, in the absence of magnetic effects, was made earlier by Bhattacharya, Ghosh & Mukhopadhyay (2010) in the model framework of coupled disc-outflow systems. In such a framework, we can see that the energetics of the disc-outflow system strongly depend on the mass, accretion rate, and spin of the black holes. Here, we explore the 2.5-dimensional disc-outflow symbiosis in the presence of large-scale magnetic field enabling angular momentum transport. The origin of this large-scale strong magnetic field near the event horizon is due to the advection of the magnetic flux by the accreting gas from the environment, say, the interstellar medium or a companion star, because of flux freezing. The magnetic field plays an indispensable role in order to generate vertical flux from the disc plane. Based on this scenario, we address the energetics of the accretion induced outflows, which are sufficient to explain the power of ultra-luminous X-ray sources (ULXs) in their hard state. We suggest that the observed hard-state ULXs are actually geometrically thick, highly magnetized, advective but sub-Eddington accretion flows orbiting stellar mass black holes and hence no need to incorporate the existence of the missing class of intermediate mass black holes, nor super-Eddington accretions.

SHORT TALK

Study of solar flares associated with CMEs affecting the geosphere

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ABSTRACT

We study 80 solar flare events associated with CMEs and produced geomagnetic storms measured as Dst index. Our study reveals that the magnitude of Dst index is significantly associated with maximum solar wind speed and peak of Bz component of the IMF, and, moderately upon the product of peak Bz and peak particle density. Impacts of the solar effects on the Earth suggests that in the beginning particles travels with higher speed and reduces as reaches to L1 point.

SHORT TALK

Exploring the additional planet in the Extra-solar Planetary System Qatar-1

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ABSTRACT

We explore the existence of additional planet in the extra-solar planetary system Qatar-1 through the analysis of transit timing variation (TTV). For this study, total thirty eight transit light curves are considered among which three high precision light curves are obtained in R band with the 2-m Himalayan Chandra Telescope during June 30, 2016 to September 10, 2016 and remaining thirty five are taken from the literature as well from the Exoplanet Transit Database (ETD). The orbital parameters of this system with precise mid-transit times are determined by analyzing the light curves with the Transit Analysis Package (TAP). Using the best fitted values of mid-transit times, we derive the ephemeris for the orbital period and mid-transit time through which the timing residuals (O-C) data are obtained to examine the presence of possible TTV signal in this system. The null TTV model provides the better fit to the (O-C) data with reduced chi-square 1.12 that shows consistency in orbital period of TrES-3b (i.e. no TTV). To check the existence of periodicity in the (O-C) data, the Generalized Lomb-Scargle periodogram is performed. The largest power of frequency 0.00399 cycle/period obtained in the periodogram with false alarm probability (FAP) of 23% which is far below the threshold value (i.e. FAP=5%) indicating that there is no existence of periodic TTV. This enable us to ruled out the existence of additional planet in extra-solar planetary system Qatar-1. Since our result show the agreement with the previous findings (see Maciejewski et al. 2015; Collins et al. 2017), whereas the disagreement with Von Essen et al (2013) and Puskullu et al. (2017), the further high precision and high cadence follow-up observations of Qatar-1 system would be required to confirm these findings.

SHORT TALK

A novel code for the early thermal evolution and differentiation of Moon

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ABSTRACT

The thermal evolution and differentiation of Moon is unique in planetary sciences as it involves the origin of Moon by a giant impact of a Mars-sized planetary body with proto-Earth. The impact resulted in the creation of a proto-lunar disk. The rapid accretion of moonlets in this disc over a timescale of ~100 years resulted in the formation of the Moon. A novel numerical code has been written in Python3 language to study the early thermal evolution and differentiation of Moon resulting in the formation of an iron-core and a silicate mantle. The code has been benchmarked against other available codes in planetary sciences dealing with the evolution of planets and satellites. Here, we present the preliminary results. Several assumptions used by earlier peers have been relaxed. For example, the gravitational energy released due to planetary segregation of metals and silicates has been appropriately incorporated for the first time. We have also relaxed the assumptions related with the thermal relaxation which we had used in our earlier related publication this year. We have also incorporated spatial grid dependent convection. This has resulted in substantial change in cooling timescale of the early Moon.

POSTERS

POSTER

Detection and Analyses of flares from solar-type stars using Kepler

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ABSTRACT

Manual detection and analysis of stellar flares in long-term time series data for several solar-type stars is an arduous task. We present a pipeline for detecting and analysing flares, primarily using the times series data obtained from the Kepler Mission. Both short and long cadence data from Kepler are very useful as they are continuous for a long time. We developed layers of detrending to remove various astrophysical and systematic variations, using a polynomial function, an ingenious Fourier detrending method and trend estimation by spline-fitted Hodrick Prescott filter. Data was lightly filtered using an original algorithm to subtract noisy variations accompanied by a Wiener filter. Flares were detected using sigma clipping algorithm. Detected flares were further analysed in order to get various flare parameter like flare duration, flare energy etc.

POSTER

Physical properties high-z CIII absorbers, its origin and evolution

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ABSTRACT

We present the evolution of 132 intervening C III + C IV absorbers at 2.1 < z< 3.4 associated with optically-thin neutral hydrogen (H I) absorbers in 19 high-quality spectra. We find a negligible evolution of C IV / C III in this redshift range. For 32 CIII components tied (aligned) with H I, we use photoionization equilibrium (PIE) CLOUDY models with the Haardt-Madau QSO+galaxy 2012 & Khaire-Srianand 2018 UV backgrounds to derive density of the gas, pressure, and temperature. From our fiducial model, we find that most of the absorbers are not in hydrostatic equilibrium and tends to origin from thermal instabilities as inferred in the simulation by McCourt et. al 2018. Finally, we show pressure-density (P - Δ) relation with power-law index γ = 1.3 which supports adiabatic expansion for these absorbers and provides evidence to one of the major reheating events i.e. HeII reionization during the epoch, 2.4 < z < 3.0.

POSTER

Cosmic Reionization with the Square Kilometre Array

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ABSTRACT

The faint cosmological signals(~millikelvin) which is expected from the Epoch of Reionization (z ~7-11) would be received at very low frequencies(100-200 MHz) i.e. by radio telescopes. They contain very high level of contamination from various foregrounds (~Kelvin). Effective strategies for foreground effect mitigation is required to detect such signals even with very sensitive telescopes like the upcoming Square Kilometre Array. We are simulating the signals that SKA-like telescopes would receive and given the currently accepted foreground models, for both galactic and extra-galactic synchrotron emissions as well as ionospheric distortions in the received signals, so as to develop a strategy for optimum foreground mitigation without appreciable loss of target signal. We use the software OSKAR developed by the UK SKA group at Oxford e-research centre, for developing visibilities and further analysis is done using the CASA software of NRAO. The mitigation algorithms thus developed would be based on python programming language. The preliminary is being done to determine the effects of telescope gain error and source position error on the overall visibilities.

POSTER

Study of X-ray Point Sources with Chandra X-ray Observatory

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ABSTRACT

A sample of data of different galaxies are selected from the Chandra public data archive from which a good number of X-ray point sources having data counts above 100 are analysed. Some sources are found to be affected with pileup issues which have been corrected using the jdpileup model. The spectra of the sources are fitted using two spectral models- an absorbed powerlaw and an absorbed diskblackbody. Based on the estimated luminosity, we have categorised the sources into X-ray binaries (XRBs), Ultraluminous X-ray sources (ULXs), Extremely Luminous X-ray sources (ELXs) and Hyperluminous X-ray sources (HLXs). We check the correlations of the estimated luminosity on the model parameters. We also perform a timing analysis of the HLXs to check any presence of variability in kilo-seconds time-scale.

POSTER

Reddening map of Magellanic Clouds using OGLE 4 Classical Cepheids

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ABSTRACT

The information of Interstellar reddening is very important in the study of stars and star clusters. Estimation of temperature, distance of stars & star clusters, fitting of cluster CM diagrams etc. requires reddening information. We study the reddening distribution across Large and Small Magellanic Clouds using Classical Cepheids (CCs) from Optical Gravitational Lensing Experiment (OGLE) Phase 4 data. We use fundamental mode (FU) and first overtone (FO) mode Cepheids for our work. Both galaxies are divided into small segments such that each segment has number of Cepheids greater or equal than 10. The period-luminosity (P-L) diagrams are drawn for each segment in V and I bands. By comparing the P-L relations with reddening calibrated P-L relations and known distance modulus of these two galaxies, we determine reddening E(V-I) in each segments. The reddening values are obtained for 130 segments of LMC with size 0.5 x 0.5 deg^2 and 141 segments in SMC with segment size 0.3 x 0.3 deg^2. The LMC reddening E(V-I) varies 0.000 mag to 0.596 mag with maximum reddening close to the star forming region 30 Doradus. The reddening E(V-I) in SMC varies 0.000 mag to 0.205 mag. Using these values reddening maps are drawn for each galaxy. The reddening can be related to stellar density distribution of CCs. In general, the study shows non uniform and clumpy structure in the reddening distribution in both LMC and SMC.

POSTER

The evolution of pre-main sequence population in the Galactic H II region Sh2-242

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ABSTRACT

Dense molecular clouds in presence of massive stars of spectral type O or early B, serve as rich astronomical laboratories for birthplaces of young stars. Sh2-242 (S242) is a highly embedded star-forming region, excited by a B0 V star and located at a distance of 2.1 kpc in the Taurus constellation. Deep NIR photometric survey reveals that the region evolves with modest values of YSO population. The region suffers highly spatially variable extinction from minimum A_v = 1.335 to maximum 5.553 mag, estimated from K-band extinction map, after removing field star contamination. S242 shows a quite larger structure as predicted from radial density profile analysis. The masses of the probable candidate YSOs varies from 0.1 $M_\odot$ to 3.0 $M_\odot$, estimated from NIR colour-magnitude diagram. Optical spectroscopic observations for few bright sources, within the region were conducted and preliminary results will be presented. A total of 38 H_α emission line objects were detected from slitless spectroscopic observations and IPHAS photometry, as majority of the H_α emitters are considered to be Classical T Tauri stars. Thus an overall picture on characterization of YSOs and molecular environment of S242 will be drawn from multi-wavelength viewpoint.

POSTER

A study of Ultra Compact X-ray Binary 1A 1246-588

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ABSTRACT

Ultra Compact X-ray Binaries are a subclass of Low Mass X-ray Binaries having an orbital period of less than or equal to an hour. Exploring the behaviour of such systems gives us an insight into the extreme physics that go on in such compact systems. 1A 1246-588 is an UCXB candidate with a neutron star as it's accretor. Very little is known about this system since this is one of the least luminous compact binaries out there and hence presents us with a lot of opportunities to explore. Also, since objects like these are so compact, they present a beautiful platform to study gravitational waves and how these systems radiate them to become such compact systems. My work has been to use data from several satellites, primarily ASTROSAT's LAXPC and SXT, RXTE, Swift and others to understand it's evolution and it's current properties in further details.

POSTER

Spectral Analysis on the Class Variable Source GRS 1915+105 Using TCAF Solution

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ABSTRACT

The class variable source GRS 1915+105 is different from the transient sources in since it exhibits a wide range of time variabilities from of the order of a few seconds to days. Depending on cts/s in different energy bands and the conventional color-color diagram, the variabilities were classified into sixteen classes and were sequenced in ascending order based on the Comptonization Efficiency. It was observed even earlier that the chi classes are harder compared to the rest of the lot, and are endowed with no significant variation in the light curve. However, all such variational features across different classes should ul-timately be originated from the variation of accretion rates, with which the TCAF solution is concerned of. This motivated us to embark upon the task of spectral analysis on this object using TCAF solution. In the $chi_{2,4}$ classes, which are reportedly devoid of the significant outflow, the spectra could be fitted using TCAF solution only, and various fitted parameters were extracted. In the $chi_{1,3}$ class, cutoff power-law model in addition to TCAF solution had to be invoked to take care of Comptonization from the outflow, and the normalization of this model along with the variation of photon index and exponential roll off factor provided us the information regarding the relative dominace of the outflow in the two classes. That enables us to come up with a legitimate picture of the emergence of the chi classes of the object in the light of accretion flow dynamics around the object.

POSTER

Detection and Characterization of Exo-planets using Indian Astronomical Facilities

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ABSTRACT

Transit photometry and transit spectroscopy are the key tools for the detection and characterization of exoplanets. We've been using the 2m Himalayan Chandra Telescope (HCT), Hanle and the 1.3m Jagadish Chandra Bhattacharyya Telescope (JCBT), Kavalur for the photometric observations of the stars of spectral class F-M in order to search for new exoplanets. Besides, as a part of the follow-up program, we have observed a few transit events by the confirmed planets such as WASP-33b, WASP-50b, HATS-18b, HAT-P-36b etc. After reducing the data, performing differential photometry and modeling the light curves with transit model given in Mandel and Agol, 2002 using MCMC algorithm we could demonstrate that we could achieve a sensitivity of ~1% with SNR of ~10 in producing transit light curves and precisely determine the properties of the planets those were verified against the published results. Besides, aiming for the characterization of the atmospheres of the exoplanets we have made some transit spectroscopic observations of some bright stars (vmag<10) using 2.34m Vainu BappuTelescope (VBT) and HCT. We acquired some high-resolution echelle spectra of the host stars during transit and outside transit and achieved an SNR of 80-150 per pixel per frame. This SNR is insufficient to draw any information regarding the planets' atmospheric contents from the spectra and for that purpose, we have been continuing our observations and adding the spectra to improve the SNR. Also, we are awaiting some large aperture telescope to be available in India for spectroscopy.

POSTER

Determination of intrinsic shape of individual elliptical galaxy: NGC 2986 using modified prior

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ABSTRACT

The determination of intrinsic shapes of the individual elliptical galaxies using photometry is an important problem because the number of galaxies with good photometry 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 each 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 individual elliptical galaxy NGC 2986 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 2986 as a function of (q_0,q_∞) for two dimensional shapes and (q_0,q_∞,$|T_d|$) for three dimensional shapes, where q_0 and q_∞(=q) are the short to long axial ratios at small and at large radii and $|T_d|$ is the absolute values of the triaxiality difference, defined as $|T_d| = |T_\infty - T_0|$. The probability is shown in the dark gray region: darker is the region higher is the probability. We find that galaxy NGC 2986 is flatter inside and rounder outside.

Keywords: Intrinsic Shapes, Triaxial Models, Photometry, Distribution and Elliptical Galaxies.

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POSTER

Confirmation of some bright new suspected variables(NSV) and their remarkable properties

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ABSTRACT

We have identified of some bright new suspected variables (NSV) and confirmed new variables by making follow-up observations through ICSP (Indian Centre for Space Physics) telescopes Vasistha (0.61m) and Arundhati (0.25m).We have used both photometry and spectroscopy for determining the optical relevant parameters.We have determined positions of the stars,magnitude variations,period of variations,variability types,spectral distributions and from where the temperatures.

POSTER

Characteristics of High-Intensity Long Duration Continuous Auroral Activities (HILDCAAs) and Estimation of Akasofu Parameters Along with Its Corrections

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ABSTRACT

High Intensity Long Duration Continuous AE Activities (HILDCAAs) are form of geomagnetic disturbances caused by intermittent magnetic reconnection. By definition of HILDCAAs, which are intense auroral activity characterized by peak AE intensity greater than 1000nT at least for 2 days and within this period the value of AE never drops below 200nT for more than 2 h at a time. In our work, we study the characteristics of HILDCAA events based on auroral electrojet index and component of interplanetary magnetic field (Bz) using continuous wavelet transform and discrete wavelet transform. We also estimate the Akasofu parameters and its corrections during HILDCAAs. We found that during HILDCAAs, there is high fluctuation in IMF-Bz with corresponding peak of AE index. The CWT analysis shows highest intensity power areas from 50 to 300 minutes for both AE and Bz during the HILDCAAs. In DWT analysis, we used higher level of decomposition to identity the common singularities present on AE and Bz. Moreover, we found that different HILDCAA events have different geoeffectiveness based on their interplanetary cause and the amount of the average energy transferred to the magnetospheric/ ionospheric system. We also found that second correction in Akasofu parameter gives nearly thrice the amount of energy predicted by Akasofu parameter without correction. This indicates that the solar wind magnetosphere energy coupling efficiency during the main phase of the storm is larger than in the HILDCAA interval.

POSTER

Hard X-ray mirrors for For High Energy Astronomy

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ABSTRACT

Development of focusing X-ray telescopes is limited to the soft X-ray band. In X-ray regime most of the materials or mediums have refractive indices nearly equal to unity and hence focusing of hard X-rays is very difficult. Using grazing incidence reflection from the multilayer X-ray mirrors this is achievable. We are developing recipes of multilayer-coated mirrors for astrophysical hard X-ray focusing telescopes. The primary technical challenges associated with the multilayer coatings and characterization of X-ray mirrors would be presented. For the characterization of multilayer mirrors we replicate IMD like simulation code for specular optical functions.

POSTER

Environment dependence of VIPERS galaxies

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ABSTRACT

VIPERS is VIMOS Public Extragalactic Redshift Survey which is completed ESO program. There are ~70000 galaxies that observed spectroscopically in this survey. These galaxies are classified by unsupervised machine algorithms and divided into 12 classes by Siudek et.al 2018. In my work, I have studied environmental dependence of these galaxies and their properties.

POSTER

ICME Profile: Primary clues for their solid body like nature

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ABSTRACT

The Aerodynamic drag experienced by Coronal Mass Ejections (CMEs) on their way from Sun to Earth is in keeping with the solid-body like character of the CMEs. In order to understand this, we have attempted to quantify the relative contributions of stagnation pressure and ram pressure on the CMEs at 1 AU. We also computed the Compressibility factor on the CMEs while propagatiing through the solar wind at 1 AU. For our analysis,we selected 12 well observed events from Nishtha Sachdeva's thesis by matching their in-situ behaviour from the MFI-SWE instrument aboard the WIND spacecraft. The analysis implies that the stagnation pressure using acoustic Mach number and thermal pressure within the Magnetic Cloud (MC) region of the ICMEs considerably exceeds the solar wind ram pressure.On the other hand, our results show that within the MC, solar wind has a much higher compressibility effect than the other regions of the ICME, supporting a good trend with the pressure cofficient. We have also seen that the Mach number fluctuations within the ICME is subsonic though the bulk flow is largely supersonic supporting the Morokovin's Hypothesis. This could be a reason that the CMEs tend to behave like a solid body with regard to their aerodynamic drag.

POSTER

Study of Horizontal Branch stars in the faint Milky Way satellite galaxies

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ABSTRACT

Horizontal branch (HB) stars belong to old and metal poor stellar population. They are one of the most luminous old population that can be probed to large distances. HB populations are found in Globular clusters, Halo and in many MW satellites. HB population displays a variety in their morphology in a color magnitude diagram. It is found to be sensitive to metallicities, age and helium abundances. Hence, they can be used to study the details of star formation history and environment of star formation. Similarly, RR Lyrae stars, which are a subset of HB stars, show different Oosterhoft types among various stellar systems. Here, we present complete census of HB stars among faint MW galaxies based on GAIA, GALEX and other optical surveys. We also present results from deep UVIT (onboard ASTROSAT, an Indian space mission) imaging for Reticulum-II satellite.

POSTER

Variability in black hole binary systems MAXI J1820+070

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ABSTRACT

We have optical observations of the new black hole candidate MAXI J1820+070. We will present the results of the analysis done of these observations and if possible compare with variability in other wavelengths.

POSTER

Understanding Physical Properties of Young M-dwarfs: Near-IR (H,K-Band) Spectroscopic studies.

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ABSTRACT

A large population of M-dwarfs (more than 70% of all stars) is becoming attractive targets as a representative of archaeological record of the chemical evolution, star formation history of the Milky Way and as potential habitable exoplanet host stars. A sample of young M-dwarfs from young moving groups and old population from the galactic field is observed using Near-IR TIRSPEC instruments (R=1200) on 2m Himalayan Chandra Telescope (HCT) at Hanle. Using interferometrically-measured effective temperatures, radii, luminosities of a sample of Calibrators with Sp.type ranging from M0V to M7V, we developed modified empirical calibration relations (Newton et al. 2015) based on low resolution near-infrared (H,K-band) spectra. The standard deviations in the residuals of our best fits for Teff, Radius and Luminosities are respectively, 102K, 0.027Rsun and 0.123(log L/Lsun). We also used empirical Sp.type standards and parallaxes to calibrate the H & K-band H2O index as indicator of Sp.type and absolute K magnitude and estimated the metallicities [Fe/H] & [M/H] of M dwarfs from Na I, Ca I equivalent width and H2O-K2 index (Rojas-Ayala et al. 2012). A luminosity-mass relation is also developed for our M dwarfs taking calibration samples from (Mann et al. 2013, 2015) .

POSTER

Spectral Analysis of GRS 1915+105 During its Evolution from χ to Heartbeat Using AstroSat /LAXPC & SXT

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ABSTRACT

We present a ∼ 90 ks full observation of the GRS 1915+105 with AstroSat when the source was making a state transtion from χ to heartbeat class. We have studied the evolution of the spectral parameters like accretion rate, inner radius(R g), Power-law constant(Γ) and fraction scatter with state transition. We have performed the time- resolved spectroscopy on the heartbeat state using simultaneous LAXPC & SXT data covering the broad energy range 0.3-80.0 keV. The variation of various spectral parameters with time is studied and a high correlation between accretion rate and the radius is confirmed with the help of cross-correlation function. A time lag of <23.775 sec is reported between Γ and accretion rate assuming that the structure of the corona is not varying.

POSTER

5D regular black hole and its shadow

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ABSTRACT

We present a five-dimensional (5D) rotating regular black hole metric, with a deviation parameter $k \geq 0$, that interpolates between the 5D Kerr black hole ($k=0$) and 5D Kerr-Newman ($r \gg k$), and is an exact solution of general relativity coupled to nonlinear electrodynamics. Interestingly, for a given value of parameter k there exits a critical value of rotation parameter $a=a_E$ which corresponds to extremal rotating regular black hole with degenerate horizons, while for $a<a_E$, one has non-extremal rotating regular black hole with outer and inner horizons. Owing to the correction factor (e^{-k/r^2}), due to nonlinear electrodynamics, the ergoregions and black hole shadows get modified.

POSTER

Timing Study of Dark GRB 130528A at differential Energy Bands.

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ABSTRACT

In the timing study, we report the results of extensively analysis of the Long Dark GRB 130528A at various differential Energy range of Soft (low) and Hard (high) bands starting from 5 keV to 100 keV in the steps of 5, which exhibited complete sequential merger of Halos of galaxies, corona of stars and hot gases in the Giant Stars. We observed three distinct bursts in the light curve in differential energy range. For these multi bursts, the measured Luminosity by SWIFT/BAT telescope varied from 3.5×10^{35} to 8.5×10^{35} J/sec. The results showed the loss of mass on an average 7.5×10^{19} kg of the system during Dark GRB 130528A in the form of radiation. This can be attributing to the mechanism described in a model for the origin of the Dark GRBs in the space.

POSTER

Astrometric and UBVRI photometric study of open clusters NGC 381 and King 21 using ground based and Gaia DR2 data

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ABSTRACT

The study of open star clusters is important to understand star formation process in the Galaxy. A precise knowledge of cluster parameters such as age, distance, chemical composition as well as stellar population distribution and cluster mass function at the time of star formation play a key role in understanding the star formation history. At ARIES, Nainital, we have been carrying out a long-term observational programme to search and characterize the variable stars in some poorly studied open star clusters. A UBVRI photometric study and Gaia DR2 kinematic study of two such open clusters NGC 381 and King 21 is presented here which has been carried out using the observations taken from 1.3-m DFOT telescope at Devasthal, Nainital and space born GAIA telescope. By deriving the stellar membership probabilities of the stars in the cluster fields, we identify the probable cluster members in order to determine the most accurate cluster parameters. To estimate the physical cluster parameters like distance, age, and reddening of the clusters, we used stellar isochrones fitting method in the observed (B − V)/V and (V − I)/V CMDs, and TCDs. We derived the luminosity functions and the mass functions for both the clusters. I will discuss the results of our survey which were derived through the photometric data taken at Nainital along with the archival 2MASS and GAIA surveys.

POSTER

Comprehensive study of two contact binaries from photometric and spectroscopic observations

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ABSTRACT

H-alpha and Na lines are considered as tracer components for studying stellar activity. Spectroscopic observations carried out for this study were centered around H-alpha line and V band photometric observations which were used to obtain the physical parameters of the two contact binaries Gaia 651478545177324544 and Gaia 662029939795414784. The light curves corresponding to the binaries in this study were analysed using Wilson-Devinney (WD) modelling technique, to estimate the geometrical and physical parameters. Only few contact binary systems in literature have been studied using H-alpha line as a diagnostic. Variation of H-alpha line at various phases was explained with respect to the activity observed in photometric studies in the form of O'Connell effect. The obtained results were compared with that of other systems to study the significance of H- alpha line observations in understanding the evolutionary phase in contact binaries.

POSTER

Properties of transient black hole candidate XTE J1752-223 during its 2009-10 outburst

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ABSTRACT

We make detailed study of the spectral and the timing properties of the stellar mass black hole candidate XTE J1752-223 during its 2009-10 outburst using RXTE/PCA data in the 2.5-25 keV enrgy range. Low frequency quasi-periodic oscillations are seen. The spectral analysis is done using two types of models: well known phenomenological disk black body plus power-law model and physical two-component advective flow (TCAF) model fits file in XSPEC. The variation of the TCAF model fitted flow parameters help us to understand accretion flow dynamics of the source during the outburst in a better way. The source show all the canonical spectral states (hard, hard-intermediate soft-intermediate and soft), which are generally could be seen during an outburst of a classical type of black hole. We also estimated mass of the black hole from our spectral analysis in the range of 8.9-9.8 Solar mass.

POSTER

Foreground Subtraction in redshifted 21cm Global Signal Experiments using Artificial Neural Networks

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ABSTRACT

Observations of HI 21 cm transition line would be an important and promising probe into the cosmic Dark Ages and Epoch of Reionization(EoR). Detection of this redshifted 21 cm signal is one of the key science goal for several upcoming and future low frequency radio telescopes like Hydrogen Epoch of Reionization Array (HERA), Square Kilometer Array (SKA) and Dark Ages Radio Explorer (DARE). Other global signal experiments include EDGES2, LEDA, BIGHORNS, SCI-HI, SARAS. One of the major challenges for the detection of this signal is the accuracy of the foreground source removal. Several novel techniques have been explored already to remove bright foregrounds from both interferometric as well as total power experiments. Here, we present preliminary results from our investigation on application of Artificial Neural Networks to detect faint 21cm global signal amidst the sea of bright galactic foreground. Following the formalism of representing the global 21cm signal by the tanh model, this study finds that the global 21cm signal parameters can be accurately determined even in the presence of bright foregrounds represented by 3rd order log-polynomial or higher. In this paper, we also deal with results of foreground removal in presence of instrumental noise.

POSTER

Exploring the Inner Solar Corona Through Fabry-Perot Interferometric Studies

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ABSTRACT

The study of the dynamics of the solar corona plays an important role in understanding the outer atmosphere of our nearest star. This study is crucial as it can affect the Earth's atmosphere. Analysis of the physical properties of various mass motions and flows in the solar corona provides a better understanding of this region. These studies might provide connections to the mysterious problems of the coronal heating and acceleration of the solar winds. We would like to present our work on the study of the characteristics of the inner solar corona explored in the radial range of 1.1-1.5 ? through the analysis of a set of Fabry-Perot interferograms obtained during the total solar eclipse of 21st June, 2001. The nature of variation of intensity, Doppler velocity, line width, asymmetry and centroid of the line profiles in this region of space and their correlations with each other is our primary concern. The study would help in better understanding of the solar coronal features.

POSTER

Formation of Episodic Jets from Black Hole Accretion Disks

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ABSTRACT

Episodic ejection of plasmoids have been observed in many black hole systems. We investigate this phenomenon by drawing analogies with the triggering of coronal mass ejections from the Sun. We envisage a plasmoid as a current carrying flux rope and consider its ejection due to an MHD mechanism called the toroidal instability. We model the velocity and acceleration profiles of the plasma blobs with our model and compare them with observations of well known sources such as 3C120 and some galactic microquasars.

POSTER

Anomaly with the Hubble parameter: Have we missed something?

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ABSTRACT

Measurements of the Hubble parameter, H_0 is a fundamental problem in extragalactic astronomy and cosmology. Recent measurements of H_0 based on time delay distance of a massive gravitational lens, HE 0435 ? 1223 at redshift z = 0.4546 have created significant tension with the CMB measurements of the parameter. Several parametric extensions of the standard general relativistic ΛCDM cosmology have been constrained by the time delay observations. Whereas constraints on the equation of state of dark energy (ω_{DE}) have produced tension with the cosmological constant, indicating the possibility of phantom dark energy, there are other theoretical possibilities which may cause an increase in the Hubble parameter. This work presents the theoretical issues with the recent measurements on this important parameter of cosmology and also discusses few implications for both theoretical and observational cosmology.

POSTER

Long Term Evolution of the Variability Classes in the Black Hole Binary GRS 1915+105

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ABSTRACT

The enigmatic Galactic black hole binary GRS 1915+105 shows a bewildering variety of variability classes and occasionally it exhibits powerful jets moving at superluminal speeds. The relationship between the occurrence of variability classes with the jet emission and the high frequency quasi periodic oscillations (HFQPO) is poorly understood due to the lack of continuous pointed observations. We make use of the data from all sky monitors (RXTE/ASM and SWIFT/BAT) to predict the variability class of GRS 1915+105 and test them with the help of existing pointed observations of RXTE/PCA. We assign variability classes to PCA observations spanning 16 years using standard 1 light curves and color-color diagrams generated with standard 2 light curves. Identified variability classes of PCA were given a numerical code of the order of ascending Comptonizing efficiency <CE>. We find that the change of variability classes is having a systematic trend for the source and it correlates with long term light curve and hardness ratio. The detailed results of the study and the distribution of variability classes and their relation to superluminal jet emissions and HFQPO emission are discussed in the paper. This can be used to predict and plan detailed pointed observations using the AstroSat satellite to make an in depth study of the disk-jet connection in this exciting black hole source.

POSTER

Effect of coronal mass ejection on Earth's magnetic field during Ascending hase of Solar cycle 24

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ABSTRACT

we have studied the width and speed of coronal mass ejection (CMEs) and geomagnetic disturbance storm time (Dst) index during ascending phase of solar cycle 23 and 24. We have classified total CMEs according to angular width and speed for the ascending period 1996-2002 and 2008-2014. we have found that the width of 62% CMEs is narrow, and3% halo for the solar cycle 23 and 73% CMEs are narrow and 2% CMEs are halo for solar cycle 24. The speed distribution of 65% CMEs has speed <= 500 km/sec and 4 % CMEs has speed >1000km/sec for solar cycle 23 and 84% CMEs has speed<=500km/sec and 1% CMEs has speed >1000km/sec in cycle 24. the relationship between width and speed is more pronounced for fast ejecta (>1000km/sec.)while slower ejecta shows more astronomically immense scatter. we have reported that the correlation between Dst and CMEs for ascending phase of solar cycle 24 is less than as compare to ascending phase of solar cycle 23.

POSTER

Observation of Near-Earth Astroid D 3200 Phaethon

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ABSTRACT

(3200) Phaethon was first discovered in 1983 by NASA's Infrared Astronomical Satellite (IRAS). Asteroid (3200) Phaethon is a Near-Earth Apollo asteroid and also a potentially hazardous object, widely known as parent body of Geminid. Its last closest approach to Earth within 0.07AU was in 2017 16th December. This is an 5.8 km Apollo asteroid with perihelion and aphelion distance 0.13991 AU and 2.4025 AU. Phaethon has an unusually high eccentricity of 0.889933. The semi-major axis and inclination of this asteroid is, 1.2712 AU and 22.253°. At perihelion (0.14 AU), its surface temperature reaches 1040 K. We observed asteroid (3200) Phaethon from 13th December 2017 to 21st December 2017 using our two telescope Vasistha (CDK-24) and Arundhati (MEADE- SN10). We present a study of the asteroid (3200) Phaethon in the 2017 and compare the results with data from the previous perihelia in 2016.

POSTER

Optical analysis of type Ia supernova 2018gv

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ABSTRACT

We wish to present the analysis of optical observations of the type Ia supernova SN 2018gv which occured in the galaxy NGC 2525. By investigating the behaviour of various physical parameters associated with the explosion of SN, we constrained the possible progeinator scenario.The light curves obtained by the broad-band optical photometric observations of the SN reveals that the SN 2018gv is found to be similar to the normal type Ia supernovae. Optical broad-band linear polarimetric observations that were obtained on seven epochs indicate an almost constant polarization with a large shift in polarizing angle, which suggests that the explosion was axi-asymmetrical.

POSTER

Study of Ultraluminous X-ray source HOLMBERG IX X-1: Analysis by TCAF solution

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ABSTRACT

Ultraluminous X-ray sources (ULXs) are the extra-galactic, non-nuclear point sources. They are more luminous than a typical X-ray binary (XRB) but less luminous than a typical active galactic nucleus (AGN). Many postulates are present in the literature to explain this high luminosity of these sources. One of the most interesting facts of this objects is the central object and its mass. It is shown that some ULXs contain a black hole at the core and some contain a neutron star. In the present context, we use Two Component Advective Flow (TCAF) model, developed by Chakrabarti and Titarchuk in 1995 to study spectral property and to measure the mass the central object of a ULX source HOLMBERG IX X-1. We use XMM-Newton satellite archival data and fit with TCAF model in 0.3-10.0 keV energy band. We also extract physical parameters such as the mass of the black hole, disk rate, halo rate, compression ratio and shock location. Our analysis confirms that HOLMBERG IX X-1 contains an intermediate-mass black hole (IMBH) which accretes in sub-Eddington rate. Our estimated mass of the black hole is 245^{+83}_{68} solar mass.

POSTER

The nature of UV/optical variability in NGC 5548

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ABSTRACT

Active galactic nuclei are known to be highly variable and luminous sources emitting in X-ray/UV/optical/IR bands. The emission is powered by accretion of matter onto the supermassive blackhole. The emission from accretion disks and the reprocessed X-ray emission dominantly in UV/optical bands in AGN. Hence, studying the UV/optical variability is important to understand the accretion disks in AGN. The variability observed in UV/optical bands is expected to be due to variations in the properties of the disk. The disk properties can vary due to intrinsic variation or due to variations in reprocessed emission from the disc. Due to degeneracy in the models which fit the observed data, we need timing studies along with spectral studies to understand the spectral components whcih drive the variability.

POSTER

Spectral And Temporal Properties of Super-Massive Black Holes in Light of Two Component Advective Flow

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ABSTRACT

We describe the spectral properties of Active Galactic Nuclei (AGNs) using Two Component Advective Flow (TCAF). This model is based on the proper hydrodynamics and radiative transfer equations. It is well established that this TCAF model is very successful to explain the spectral properties of the stellar-mass black hole. Here we try to establish that it is equally applicable to explain AGNs spectra. We use the observational data from NuSTAR and XMM-Newton satellite for two nearby AGNs: NGC 4151 and NGC 7469. We use the TCAF model as an additive local model directly in XSPEC. Our aim to determine the mass of the central super-massive black hole with less uncertainty. Beside this, we also discuss the accretion dynamics and flow geometry around the black hole on the basis of the model fitted parameters. A power law component also needed to fit a high energy spectrum which indicates the hard state of the source. This is the first time we apply this model in XSPEC to fit AGN data.

POSTER

Spectro-temporal study of GRS 1716 - 249 using Swift/XRT and NuSTAR

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ABSTRACT

In this work, we present the spectro-temporal study of GRS 1716-249 during its historical mega outburst continuing since 2016 December, using two observations made from Swift/XRT and NuSTAR observatories on 2016 April, 7th & 10th. We have carried out joint-spectral analysis which shows the presence of a broad iron line and reflection bumps around 1 and 30 keV. Our work reports the NuSTAR detection of low frequency QPO ∼ 1.20 ± 0.04 Hz in LMXB GRS 1716−249 for the first time. The time-resolved analysis hints of a variation in the QPO frequency in the second epoch. Our analysis establishes a strong correlation between QPO frequency and power-law index.

POSTER

Study of initiation, Interplanetary Consequence and Geo-effectiveness of CME Associated

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ABSTRACT

In this paper we present the multi-wavelength analysis of a major X-class (X9.3) fare that occurred in active region NOAA 12613 on September 06,2017 during 11:53 UT to 12:10 UT. this event also produced a fast Coronal Mass Ejection. Active region NOAA 12673 emerged at S09W30 on September 06, 2017 and grew rapidly to a large active region. its maximum area was 1060 millionth of the solar hemisphere on 09 September. the group disappeared over the west limb of the Sun(S09W83) on 10 sep. it was a fast emerging flux region. the group showed beta-gamma-delta magnetic configuration. We identified their earliest signatures of eruption in AIA 94A images with activation and successive rapid expansion of hot channel-like structures from low coronal heights. on other hand this flare event gives rise the intense Dst at 1 AU (-142nT). The observation from the source active region to the corona, interplanetary medium and in-situ measurement at 1 AU, we identify complex processes of CME-CME interaction that have significantly contributed to make this event such geo-effective.

POSTER

Understanding the evolution of cool contact binaries selected from OGLE

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ABSTRACT

We present the first Photometric analysis of 15 cool contact binaries. The V band photometric data collected from OGLE database were initially analyzed using Phoebe and later using Wilson Devinney (WD) code (2003). The versatile range of photometric and absolute parameters derived from the analysis were used to understand the evolution of these binaries, while strengthening the Angular momentum loss (AML) and Thermal Relaxation Oscillation (TRO) models. Among the binaries in this study, four of them showed over-contact configurations and two binaries showed the O'Connell effect. Evolution of cool contact binaries were believed to be influenced by magnetized winds, which were dominant in the sub-photospheric convective zones of cooler main sequence components. Such evolution of cool contact binaries are not well established through observational studies. Therefore, in this study derivation of the fundamental parameters and characteristic studies of such unexplored cool contact binaries, is an attempt to emphasize the importance of close binary models to describe their origin and evolution.
Key words: Photometric, Cool, Contact Binaries, AML, TRO.

POSTER

Modeling the Morphology and Ionization Structure of Planetary Nebula PB 1

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ABSTRACT

Planetary nebulae (PNe) form around low- to intermediate-mass stars when they shed their outer layers into interstellar space around them during the late phase of evolution. While studying a PN can help in understanding the chemical and dynamical evolutionary history of the progenitor, accurate physical models that theoretically represent the object of study gives a complete picture along with precise determination of the parameters. In this work we construct 3D morphological and photoionization models of a very less-studied PN PB1, for which we use archival HST Hα image and optical spectra obtained using 2 m HCT, Hanle, India respectively. The morphology reveals a structure having three components (two inner shells and a halo) all having certain degrees of bi-polarity while orienting in different directions. We estimate the elemental abundances of PB1 and significant physical parameters of the central star (e.g., temperature, luminosity) and the nebula (e.g., density) as the results of the photoionization modeling and analyse the ionization structure of the PN. We also discuss the implication of the models towards understanding the PN in chemical and dynamical evolutionary aspects.

POSTER

Fermi-LAT observations of brightest gamma-ray flare ever detected from CTA 102

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ABSTRACT

A multi-wavelength study of FSRQ CTA 102 has been done using the Fermi-LAT and simultaneous Swift-XRT/UVOT observations. Fermi-LAT detected one of the brightest flare from this object during Sep 2016 to Mar 2017. A deatiled analysis of the temporal and spectral properties of the flare indicates that source was very bright on 29 Dec 2016 with a flux of 30.12e-6 ph/cm^2/s. This has been found to be the highest flux ever detected from Blazar CTA 102. We have also focussed on time dependent modeling of flares by using time dependent code GAMERA. In result, we have found that a single emission region of size 6.5e16 cm can explain the multiwavelength spectral energy distributions (SEDs). During the flares it also found that the luminosity in electrons increases nearly by seventy times compared to the quiescent state.

POSTER

Galaxy And Mass Assembly: Correlation with ALFALFA HI sources

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ABSTRACT

We compile a sample of HI-rich galaxies and study their properties at other wavelengths, their environment and morphology to understand their evolution. Our sample contains 361 galaxies in the redshift range $0.002 < z < 0.06$ and comprise a variety of morphologies from early-type spirals to late-types and Sd-Irregular. We use data from the Galaxy and Mass Assembly (GAMA) and Arecibo Legacy Fast Arecibo L-band Feed Array (ALFALFA) surveys. The spectroscopic and photometric data from GAMA provides an insight into the environment, morphology and the dust content of the HI-detected galaxies. ALFALFA provides HI mass for these common galaxies. In this work we analyse the colour, dust mass, stellar mass, star formation rate (SFR) and neutral hydrogen (HI) mass of the HI-detected galaxies. We find that SFR is highly correlated with HI mass and dust mass. We divided our sample into red and blue galaxies and find that red galaxies have low specific star formation rate (sSFR) and high metallicity. We determine the doubling time and gas depletion time which suggests that red galaxies will finish their HI gas before doubling their stellar mass. This implies that red galaxies are more evolved than their blue counterparts. We also find that red spirals are more likely to reside in denser environment than other galaxies in our sample despite having high HI mass and stellar mass.

POSTER

Analysis of dust forming novae

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ABSTRACT

Out of a large number of observed novae, only a few (~20% - 25%) have been found to form dust in the ejecta. Study of dusty novae helps us to understand the process of dust formation and the physical parameters. We have studied two dusty novae, V1280 Sco (Nova Scorpii 2007), a nova that formed optically thick dust, and V476 Scuti (Nova Scuti 2005), a nova that formed optically thin dust. Here we present the results of photo-ionisation modelling of the observed emission spectra. We used photo-ionisation code CLOUDY C17.00 (Ferland et al, 2017) for modelling observed optical and NIR spectra. We generated several spectra of different epochs by varying associated parameters, such as, temperature and luminosity of the central star, hydrogen density and size of ejecta, elemental abundances etc. From the best-fit model, we estimated various physical parameters and also identified the spectral features in more details.

POSTER

Polarization towards the star cluster Alessi 1

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ABSTRACT

We will present the linear polarimetric observations for 79 stars in the open star cluster Alessi 1 in B, V, R, and I photometric bands using AIMPOL (Aries IMaging POLarimeter) mounted at 104-cm Telescope ARIES, Nainital. The average values of the polarization for the cluster Alessi 1 are found to be 0.85?0.39%, 0.79?0.31%, 0.89?0.30%, 0.86?0.30%, in B, V, R, and I bands, respectively, where as the average values of position angles are found to be 53.5?8.2, 57.9?11.9, 60.1?12.5, 54.7?8.9 degree, in B, V, R, and I bands, respectively. Some of the observed stars have shown the indication of intrinsic polarization in their measurements. The estimated mean value of wavelength at maximum polarization indicates that the average size of the dust grains within the cluster is similar to that in the general interstellar medium. Cluster membership and basic cluster parameters are also derived based on polarization and proper motion. Cluster membership probabilities were derived for stars within 12 arcmin radius of the open star cluster Alessi 1. A reddening of E(BP − RP) = 0.18 ? 0.04 mag, a distance of 692?16 pc and an age of ∼ 0.9 Gyr were derived using stars.

POSTER

A theoretical approach of compact stars in low-mass X-ray binaries

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ABSTRACT

In this research work, we propose a theoretical model for compact stars(strange stars) in low-mass X-ray binaries(LMXBs) namely KS 1731-260, EXO 1745-248 and 4U 1608-52 under Tolman VII metric . Here we investigate the physical characteristics of compact stars in the LMXBs. Using our model, we have calculated central density, surface density , central pressure, compactness, surface red-shift and maximum mass for the above mentioned compact stars(strange stars), which is very much consistent with the reported data. We also obtain the possible equation of state(EoS) of the stars which is physically acceptable.

POSTER

A Search for Fast Photometric Variability of Brown Dwarfs and Very Low Mass Stars in IC 348

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ABSTRACT

We present here our preliminary results from ground-based optical I-band photometric monitoring observations of few young brown dwarfs (BDs) and verylow-mass stars (VLMs) in IC348 using 2m HCT and 1.3 DFOT telescopes. IC 348 is a star-forming region in Perseus Molecular Cloud having an age of 2-3 Myr. Our preliminary analysis shows prominent variability features in a few sources on few selected regions of IC 348. The I-band light curves analysis of these VLMs show the variability periods of few hours, which are attributed to the fast rotational period in this kind of young VLMs.

POSTER

Accretion in five component elliptical galaxy : Multitransonicity, shocks and implications on AGN feedback

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ABSTRACT

Isolated massive ellipticals, or that are present at the centre of cool-core clusters, are widely argued to be powered by hot gas accretion directly from their surrounding hot x-ray emitting phase. This leads to a giant Bondi-type spherical or quasi-spherical accretion flow onto the central SMBH, even exceeding hundreds of kpc length-scale, particularly, in context of flows from ICM. We incorporate the entire galactic contribution to the potential considering a five component elliptical galaxy (SMBH + stellar + dark matter + hot gas + Lambda). The adiabatic spherical flow displays a remarkable behavior, with the appearance of multi-criticality in the flow, indicating significant departure from the classical Bondi solution. More notably, corresponding to moderate to higher values of mass-to-light ratios, we obtain possible Rankine-Hugoniot shocks in the corresponding wind flows, with the global flow topology resembling the x-alpha -type trajectories of advection accretion flows. Galactic contribution to the potential enhances the Bondi accretion rate. Our study reveals that there is a strict lower limit of ambient temperature below which no Bondi-type accretion can occur; which is as high as 9X10^6 K for flows from hot ISM-phase, indicating that for isolated ellipticals, the hot phase tightly regulates the fueling of host nucleus, enabling a tight feedback to occur between them.

POSTER

The IERCOO Transiting Exoplanet Survey

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ABSTRACT

The IERCOO, a branch of Indian Centre for Space Physics is aiming to discover exoplanets by transit photometry method using its own telescopes. IERCOO operates two robotic reflecting telescopes of aperture 0.61m and 0.25m. This presentation consists of IERCOO instruments, observation strategy, data reduction and follow-up observation for discovering the exoplanets by transit method. We are presenting the light curves of the stars of some arbitrary field near Gemini constellation. The photometric precision is nearly 1-2%.

POSTER

Transport of angular momentum in accretion disks from hydrodynamics point of view.

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ABSTRACT

The observed data imply the turbulent nature of accretion disks. In the absence of turbulence, we cannot explain the transport of matter and various observed signatures of the disk like temperature, luminosity, etc. However, a disk must be unstable first before revealing turbulence. For the hot disk we could explain the instability and subsequent reason for the turbulence. It may be the magnetorotational instability (MRI). But in the cold disks (with temperature below 3000 K) MRI may cease to operate and the flow is Rayleigh stable. In addition, there are other evidences where MRI do not work (e.g., where the toroidal component of magnetic field is huge, etc.). Hence, we try to explore whether the origin of the instability (which further could lead to turbulence) can be explained using hydrodynamics only. Our particular emphasis is the effect of stochastic noise. In a first set of work, we have explored the WKB solution of the perturbations and investigated the possible origin of linear instability (i.e. exponential growth) of perturbations, which was absent without noise. Subsequently, we have explored the equation for the evaluation of amplitude of the weakly nonlinear perturbations. This is known as the Landau equation, but now we consider it in the presence of noise. Here we confirm that the dependences of the growth of perturbation on the noise and the amplitude of the perturbations are similar to that of the linear stability analysis. Moreover, if the nonlinear perturbations are also destabilizing, the occurrence of instability is very fast. Therefore, linearly stable but nonlinearly unstable flows can be made unstable very quickly by the inclusion of noise.

POSTER

The atmospheres of cool hydrogen-deficient carbon stars

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ABSTRACT

Abundance analyses of five cool non-variable HdCs, HD137613, HD148839, HD173409, HD175893 and HD182040 have been carried out. In the literature, the abundances analyses of these stars are based on the spectra recorded on the photographic plates combined with the classical curve of growth analysis. So, our aim is to measure the accurate surface abundances of these stars using high resolution CCD spectra by determining their stellar parameters using line-blanketed model atmospheres for R Coronae Borealis stars and hydrogen-deficient carbon stars as described by Martin Asplund et al.(1997) and the line-formation calculations to be worked out with the Uppsala LTE line formation code EQWIDTH. We expect that a detailed study of abundances of these stars should provide us with valuable insights on their origin and their connection to DY Per stars, RCrB stars and EHe stars.

POSTER

The hot graphite dust in the sublimation zone of NGC 4151

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ABSTRACT

The thermal emission of hot dust inside the Active Galactic Nuclei(AGN) is one of the key factors which is responsible for existence of high near-IR excess in the spectral energy distribution (SED) of AGN torus of NGC 4151(Seyfert 1.5 AGN). The results obtained from the observational data in the near-IR wavelength, the temperature of the hot dust was found to be ~ 1300Kelvin. At such high temperature, only graphite and silicate grains can survive. Although from literature, the innermost radius of NGC 4151 torus are found to be 0.04pc and 0.1pc which gives the idea about two dust origin. As It is very difficult to practically resolve the innermost radius of torus, we model the sublimation zone (area in the vicinity of the innermost radius of torus) of NGC 4151 using a radiative transfer SKIRT code (developed by M.Baes et al. 2003,2011, 2015). We simulate the code at various suitable inner radii of torus (from 0.07pc to onward) to get the near-IR excess. We present here, a study of the variation of the near-IR emission with the innermost radius of dusty torus of NGC 4151, which ultimately gives an idea about the range of sizes of the grains which can survive in the hot environment. The result suggests that the region proximity to the black hole may consists of graphite dust grains with larger size around 0.18micronmeter whereas silicates grains cannot survive.

POSTER

Thermal and non-thermal processes caused by large-scale restructuring of coronal magnetic fields driven by the flux rope eruption

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ABSTRACT

Exploration of solar source region characteristics of large-scale flux rope/prominence eruptions is vital to understand the space weather conditions in our solar system. With this motivation, we present a multi-wavelength analysis of a partially erupting filament associated with an M6.7 flare from the active region NOAA 12371 on 2015 June 22. The prominence eruption evolved into a huge, ultrafast, halo coronal mass ejection. In this study, we combine observations from the Atmospheric Imaging Assembly and Helioseismic Magnetic Imager on board the Solar Dynamics Observatory, RHESSI and Big Bear Solar Observatory. GOES 1-8 Å soft X-ray (SXR) flux indicates this flare to be a typical long duration event (LDE), causing prolonged thermal emission for >3 hours. The flare light curves in SXR and extreme ultraviolet (EUV) energy bands suggest distinct peaks during pre-flare and precursor phases which is associated with triggering reconnection and heating of a pre-existing quasi-stationary flux rope. Interestingly, the main phase of the flare was associated with two distinct peaks separated by ~15 minutes. The \beta\gamma type active region consisted of two spatially well separated sunspot groups with the leading and trailing groups showing unipolar and bipolar magnetic structures on the photosphere, respectively. Chromospheric Hα and EUV observations suggest the bipolar sunspot to be associated with a filament lying over the polarity inversion line which partially erupted giving rise to the impulsive emission with strong non-thermal characteristics, causing the first SXR peak. The filament eruption was followed by intense diffused emission from the newly formed post-flare arcade giving rise to the gradual, second SXR peak. In the gradual phase of the flare, we find emission from a second layer of post-flare arcade which was situated high in the corona connecting the positive portion of the bipolar sunspot with the unipolar negative polarity sunspot. We have carried out magnetic field modeling of the active region corona to explain our observations in the light of breakout versus thether cutting models of solar eruptions.

POSTER

Modified gravity to unify sub- and super-Chandrasekhar limiting mass white dwarfs

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ABSTRACT

Einstein's general theory of relativity is an incredible theory to explain various astrophysical phenomena e.g. solar system etc. and early universe cosmology. It provides an immense understanding of physics of various compact objects e.g. black holes, neutron stars, quark stars etc. However some recent observations in cosmology and also compact objects question the complete validity of general theory of relativity in extremely high density regions. Again we know that a white dwarf, as it pulls matter from its companion star, gives rise to type Ia supernova (SNeIa). At a certain mass, known as Chandrasekhar mass limit (currently accepted value is 1.4 solar mass for a carbon-oxygen white dwarf), white dwarf becomes unstable and it burns out without leaving any remnant behind. Nevertheless, some recent astrophysical observations argue that the value of Chandrasekhar mass limit has to be violated. Howell et al. (Nature 443, 308, 2006), Scalzo et al. (Astrophys. J. 713, 1073, 2010) etc. detected extremely high luminous supernovae which they have argued to be originated from white dwarf of mass as high as 2.8 solar mass. On the other hand, Filippenko et al. (Astron. J. 104, 1543, 1992), Modjaz et al. (PASP 113, 308, 2001) etc. have detected supernovae with extremely low luminosity which had to be originated from white dwarf of mass as low as 0.5 solar mass. Das and Mukhopadhyay, (JCAP, 05, 2015, 045) showed for the first time that these two classes of white dwarf can be explained using modified theory of Einstein's gravity. They used Starobinsky's f(R) gravity model to explain these phenomena. In the talk, I will explore how these phenomena can be explained using various forms of f(R) gravity. Here I will use some properties of the white dwarf to explain these phenomena rather varying the parameters of the model.

POSTER

Spectral and temporal study of LMC X-1 with a joint XMM-Newton and NuSTAR observation

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ABSTRACT

We present the spectral and temporal analysis of a simultaneous observation of the high massive black hole binary LMC X-1 by X-ray Multi-Mirror Mission (XMM-Newton) and Nuclear Spectroscopic Telescope Array (NuSTAR) on November 9, 2014. The broad band energy range upto 79 keV of the NuSTAR data appears to be very useful to model the Comptonization component in the X-ray energy continuum which arises due to reflection of the Comptonized photons from the disk. We have found a significant variation in the hardness and observed X-ray flares in both observations. We also detect strong iron K alpha line with statistical significance at 8.7σ. To model the time averaged X-ray energy spectra, we have applied absorbed multi-colour disk blackbody model along with the relativistic reflection model RELXILL to account for the fluorescent iron K alpha line as well as the effect of Comptonized emission. The spin value of the source has been found to be high (~0.9) and inner disk is truncated at 14 ISCO. Steep powerlaw component with Γ value of 2.67 implies the source to be in high/soft state. Although mHZ QPOs have been detected earlier in this source with XMM-Newton and Suzaku observations, we notice that QPO was absent in the power density spectra during this observation. Furthermore, a comparative study with the previous results on this source has been reported in this work.

POSTER

Co-relating X-ray, ultra violet and optical study of variable Ultra luminous X-ray source in the field of HolmbergII dwarf galaxy

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ABSTRACT

We have been observing the field of Holmberg II dwarf galaxy which contains a variable Ultra luminous X-ray Source (ULX). Despite intensive studies of the ultraluminous X-ray sources (ULXs) both in X-rays and in optical, there is still no strong and obvious evidence to distinguish among two competitive models: whether they contain stellar-mass or intermediate-mass black holes (IMBHs). Recent data show that both UV and optical emissions may be reprocessed in strong heating by X-rays, where UV-optical spectral energy distribution hints at two-component spectra. We conducted three epochs of astrosat observations, tested the Ultra violet (UV) and optical responses to the X-ray variability. Our main goal is to study correlations between the X-ray-UV-optical data, and to elucidate the model as either a donor and supercritical accretion disk, or a donor and standard irradiative accretion disk with IMBH. We have analyzed the data and presently combined the SXT/UVIT fluxes of the ULX. In addition to the ULX, there is an interesting group of three galaxies in the field of Holmberg II. A peculiar ring galaxy is one among the three. Rings and tidal tails in early-type galaxies are usually considered to be triggered by mergers and/or interaction. We investigate the star formation history of the group of three galaxies showing signs of merger and interaction using high-resolution FUV and NUV images from UVIT on Astrosat and high-resolution optical spectroscopy from SAO 6-m telescope. The UV emission enables testing whether these galaxies host ongoing or recent star formation.The UVIT Near-UV (NUV) and Far-UV (FUV) images of all three galaxies show complex ring, tidal tails and debris structures. The UV morphology of the ring galaxy appears to be completely different from the optical morphology. In both UV bands, the ring is the dominant structure not seen in the optical/IR images. We try to constrain the age of the merger episode that produced the ring. As an additional bonus, we confirm the nature of the object in the field of this group as a quasar at a redshift of ~ 0.7. This object was earlier classified as a candidate quasar. We present a study of the group of three galaxies displaying the signs of the recent merger/interaction.

POSTER

Some glimpses of plasma process involved in pulsar radio emission mechanism

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ABSTRACT

There are mainly three ways in which an electromagnetic wave can undergo scattering in plasma: (i) when the scattering of radiation occurs by a single electron, it is called Compton scattering (CS); (II) if it occurs by a longitudinal electron plasma mode, it is called Stimulated Raman Scattering (SRS), and (iii) if it occurs by a highly damped electron plasma mode, it is called Stimulated Compton Scattering (SCS). The non-thermal radio emission produced in pulsar magnetosphere is believed to be produced by SRS. We consider the role of propagation effect such as Stimulated Raman Scattering on the polarization of radio pulses. When an intense electromagnetic wave with frequency close to plasma frequency interacts with the plasma in pulsar magnetosphere, the incident wave undergoes through SRS process. Under some conditions, we find that the polarization properties of the scattered mode can become significantly different from those of incident wave. The frequencies at which this prominent SRS process occurs in the outer parts of pulsar magnetosphere, is falling in the radio band of electromagnetic counterpart. Using typical plasma and magnetic field parameters for pulsars, we compute the growth rate, flux spectra and have studied the polarization properties of scattered mode. We also have tried to estimate the brightness temperature numerically from growth rate expression, by using typical pulsar parameters.

POSTER

Spectral and Timing analysis of Black hole source MAXI J1535-571

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ABSTRACT

Black hole binaries are ubiquitous in the galaxy. Studying the high energy radiation from such sources proves to be an excellent probe understanding the physics of accretion disks. MAXI J1535-571 is a new discovered X-ray transient source which from the preliminary spectral analysis seems to be an accreting black hole binary system. It has been observed by multiple observatories at different stages of the outburst. The speaker will present the results of the analysis conducted on a 5-day long observation by ASTROSAT during the rising phase of the outburst. Correlation between the spectral and timing features and its implications will also be discussed.